

WILLIAM H. DALL
SECTIONAL LIBRARY
DIVISION OF MOLLUSKS

THE GENUS DRUPA IN THE INDO-PACIFIC

by WILLIAM K. EMERSON

Department of Living Invertebrates
The American Museum of Natural History
New York, N.Y. 10024

and

WALTER O. CERNOHORSKY

Auckland Institute and Museum
Auckland, New Zealand

Abstract

A revised classification of the gastropod genus *Drupa* Röding (Muricidae: Thaidinae) is presented. The following taxa are recognized: *Drupa (Drupa) morum morum* Röding, 1798; *D. (D.) morum iodostoma* (Lesson, 1840); *D. (D.) ricinus ricinus* (Linnaeus, 1758); *D. (D.) ricinus hadari* Emerson and Cernohorsky, new subspecies; *D. (D.) elegans* (Broderip and Sowerby, 1829); *D. (Ricinella) rubusidaeus* Röding, 1798; *D. (R.) speciosa* (Dunker, 1867); *D. (R.) clathrata clathrata* (Lamarck, 1816); *D. (R.) clathrata miticula* (Lamarck, 1822); *D. (Drupina) grossularia* Röding, 1798; and *D. (Drupina) lobata* (Blainville, 1832). Generic and specific synonymies are given for these taxa, together with distributional and ecological data for each species.

Indo-Pacific Drupa

Species of the genus *Drupa* Röding are confined in their distribution to the tropical Indo-Pacific region, where they are commonly encountered on intertidal reef-flats. *Drupa* species are muricean gastropods which show a close relationship with the larger, but otherwise similar and closely related species of *Thais* Röding, and are currently assigned to the subfamily Thaidinae within the family Muricidae. Because of the close similarity in shell morphology, species of *Drupa* Röding, and *Morula* Schumacher have frequently been considered to be congeneric or only subgenerically separable. Wu (1965b), in his comparative study of the functional anatomy of the

digestive systems of *Drupa ricinus* (Linnaeus) and *Morula granulata* (Duclos), found morphological differences in features of the radula, gland-gut complex, stomach and rectal gland, and most notably in the structure of the salivary glands.

The exterior of the animal of *Drupa* consists of a foot with an attached, chitinous operculum, a head, snout, proboscis, pair of tentacles and eyes and the reproductive organ. Animals are dioecious, with the male's penis situated behind the right tentacle below the thin mantle. The operculum is brown in color and corneous, stereotyped thaidine in appear-

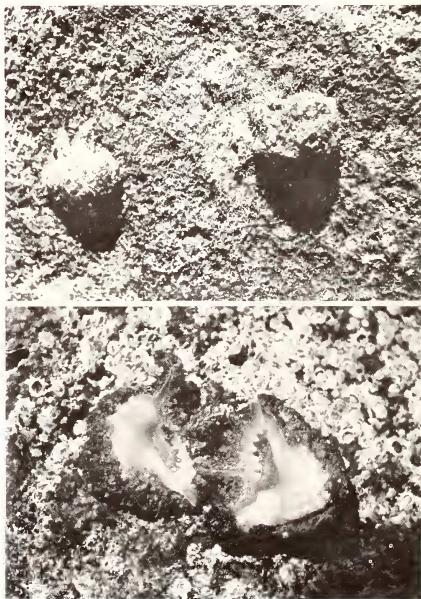


Plate 1. Camouflage in *Drupa (Drupina) grossularia* Röding. Cape Tuolemnu, Upolu, Samoa Ids. Top figure: Two specimens *in situ* on an exposed algae-covered reef. Bottom figure: two over-turned, living specimens on reef (photo courtesy A. Solem).

ance, with a series of plateaulike ridges on the side of attachment and concentric growth-rings on the exterior which converge basally into an ill-defined nucleus (see pl. 3, figs. 1-4).

In the Fiji Islands and the New Hebrides, *Drupa* were encountered in the mid-eulittoral and upper eulittoral region of the intertidal zone, generally on windward and exposed reef-flats. Species were considerably less numerous on protected, coral-strewn or shingle-covered leeward reefs. *Drupa morum* Röding, *D. rubusidæus* Röding, and *D. ricinus* (Linnaeus) were most frequently collected on exposed algal ridges which were constantly kept moist through agitated waters and a breaking surf. The same species occurred on reef-edges covered with calcareous algae and detritus. *Drupa ricinus*, however, also occurred in the mid-eulittoral zone, while *D. grossularia* Röding, was usually confined to this part of the reef-zone. Kay (1971), in her study of the molluscan fauna of Fanning Island in the Line Islands, reported *D. ricinus*, *D. morum* and *D. grossularia* to be the most common macro-mollusks inhabiting reef-flats. *D. ricinus* and *D. grossularia* were among the dominant species of the beach-rock assemblages, with the former species restricted to exposed areas. *D. ricinus* also occurred on a subtidal, lagoonal patch reef, but was found to be far more abundant on seaward reefs than on the patch reefs in the lagoon. Salvat (1970), in his study of littoral molluses of Fangataufa, Tuamotus, found a similar distributional pattern of *Drupa* as that observed by the junior author in Melanesia, with *D. ricinus* being more frequent on seaward algal ridges and *D. morum*

occupying the mid-eulittoral zone. Demond (1957) reported *D. grossularia* as occurring in Micronesia most commonly on windward reef flats on rocks near the low tide line, less frequently on leeward reefs and rarely in lagoons. *D. morum morum* was recorded commonly found living among rocks and coral of windward reef-flats and on windward lagoonal reef-flats of the larger atolls, but rarely on leeward reefs. This species was encountered most often near the low tide line, on or near the reef-edge, but also was taken in tide pools across the entire reef-flat. *D. ricinus* was reported to occupy a similar habitat to *D. morum morum*, while *D. rubusidæus* was found to inhabit both windward and leeward reef-flats, living under rocks and coral rubble; it also occurred in tide-pools near, or just below the low tide line, and was found also living on coral heads off the seaward reef-edge, in 10 to 15 feet of water. Heinicke (1970) encountered *D. lobata* (Blainville), seemingly always occurring in pairs, in the lagoonal channel among coral heads at Diani Beach, Kenya.

Drupa species are commonly encrusted with algae, coral growth, vermetids, Foraminifera, *Hipponix* and other extraneous organisms, making them blend in with the substrate upon which they rest (see pl. 1). Nothing is known about natural enemies of *Drupa*, except that Schoenberg (1971) records captive *Conus textile* Linnaeus preying on *Drupa morum*, "*D. speciosa*" (= *D. rubusidæus*), and both color forms of *D. ricinus*, among numerous other species of Hawaiian prosobranch gastropods.

Conflicting reports may be found in literature on the feeding habits of *Drupa* species. Salvat (1970) examined the microscopic con-

Figs. 1-3. *Drupa (Drupa) morum morum* Röding, 1798. 1, Chisimai, Somalia (ANSP 298192); 2, 3, adult and immature, both from Okinawa Id. (ANSP 302577).

Figs. 4, 5. *Drupa (Drupa) morum iodostoma* (Lesson, 1840). Both from Ua Huka Id., Marquesas Ids. (ANSP 155617 and 156169).

Figs. 6-8, 11. *Drupa (Drupa) ricinus ricinus* (Linnaeus, 1758). 6, Okinawa Id. (ANSP 302919); 7, 11, Mahé, Seychelles Ids. (ANSP 266229); 8, immature, Moorea, Society Ids. (ANSP 283222).

Figs. 9, 10. *Drupa (Drupa) ricinus* new subspecies *hadari* Emerson and Cernohorsky, 9, paratype (AMNH 112617a); 10, holotype (AMNH 166928). Eilat, Gulf of Aqaba, Israel.

Fig. 12. *Drupa (Drupa) elegans* (Broderip and Sowerby, 1829). Society Islands (ANSP 199558).

Figs. 13-15. *Drupa (Ricinella) rubusidæus* Röding, 1798. 13, Gesira, Somalia (ANSP 299187); 14, Isles Radama, N.W. Madagascar (ANSP 257243); 15, immature; Malaita Id., British Solomon Ids. (ANSP 289624).

Figs. 16-18. *Drupa (Ricinella) clathrata clathrata* (Lamarck, 1816). 16, Okinawa Id. (ANSP 289725); 17, Iliavao Id., Marquesas Ids. (ANSP 155492); 18, Pacific Ocean (ANSP 36720).

Figs. 19, 20. *Drupa (Ricinella) clathrata miticula* (Lamarck, 1822). 19, Arsenal Bay, Mauritius (ANSP 273087); 20, Mahebourg, Mauritius (AMNH 104995).

Figs. 21, 22. *Drupa (Ricinella) speciosa* (Dunker, 1867). Both from "Rarotonga, Cook Ids."—probably an error (ANSP 29873). Known from the Tuamotus and Pitcairn Islands.

Figs. 23, 24. *Drupa (Drupina) grossularia* Röding, 1798. 23, Okinawa Id. (ANSP 225428); 24, immature, Sorsogon, Luzon Id., Philippines (ANSP 224148).

Figs. 25, 26. *Drupa (Drupina) lobata* (Blainville, 1832). 25, Mogadiscio, Somalia (ANSP 295772); 26, Direction Id., Cocos-Keeling Ids., Indian Ocean (ANSP 28455).

(all figures about natural size)

Plate 2. Genus *Drupa* Röding in the Indo-Pacific

(all figures about natural size)

Explanation on opposite page.

tents of the digestive tracts of several reef-dwelling gastropods and decided that *D. rici-nus* and *D. morum morum* were herbivores, whereas other authors (Wu 1965b; Taylor 1968; Kay 1971; Cernohorsky, personal observation) report these species to be carnivores. The feeding habits of the following species have been reported:

Drupa morum morum

worms and sipunculids (Kay, 1971) [Line Ids.]

barnacle *Tetraclita squamosa* (Taylor, 1968) [Seychelles Ids.]

herbivorous (Salvat, 1970) [Tuamotu Ids.]

sipunculid worms (Cernohorsky, pers. ob-servation) [New Hebrides]

Drupa ricinus

live prey, i.e. sponges and holothurians, or carrion (Wu, 1965b) [Hawaiian Ids.]

molluscs, barnacles and worms (Kay 1971) [Line Ids.]

Drupa grossularia

omnivorous (Salvat, 1970) [Tuamotu Ids.]

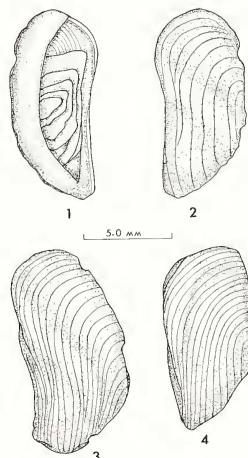


Plate 3. Opercula of *Drupa*.

Figs. 1, 2. *Drupa (Drupa) morum morum* Röding, from Nanau-i-Ra Id., Fiji Ids. 1, inner surface; 2, outer surface.

Fig. 3. *Drupa (Ricinella) clathrata clathrata* (Lamarck), from Pango Point, Efate Id., New Hebrides.

Fig. 4. *Drupa (Drupina) grossularia* Röding, from Wadigi Id., Fiji Ids.

In comparison to *Drupa* species, *Morula granulata* (Duclos) was reported to feed on other mollusks and barnacles in the Seychelles Islands (Taylor, 1968), but was recorded preying on holothurians, boring into bivalves of *Isognomon* and *Ostrea*, and consuming carrion in the Hawaiian Islands (Wu, 1965b).

No information is recorded on the mode of reproduction of *Drupa*, although J. B. Taylor (*in litt.*) reports certain Hawaiian species of *Drupa* (*sensu lato*) to have planktonic veligers. Such a larval stage would account for the wide distribution of most species.

Radulae

The radula of *Drupa* is of the rachiglossate type, with 3 teeth per transverse row with a formula of 1-1-1. The radular ribbon is small and very narrow, and the lateral teeth are simple and sickle-shaped (see pl. 4, fig. B). The rachidian teeth are more or less subquadrate or rectangular, the base is weakly concave, the central cusp is slender and longer than the flanking, bifid to quadridifid side-cusps. The lateral denticles are small, moderately deeply rooted and number from 2 to 5, and the end-cusps are usually slightly larger than the lateral denticles (see pl. 4, fig. A).

Although the shells of *Drupa* show an affinity with species of *Morula* Schumacher, the radulae of the moruline group of species differ in the following particulars: the central cusp of the rachidian is more deeply rooted, the flanking side-cusps are not multifid as in *Drupa*, but are simple, and the central cusp and side-cusps are separated from each other by an interposing small, intermediate cusp. The radula of *Morula* is essentially muricine in appearance while that of *Drupa* is a weakly modified thaidine radula, which approaches that of *Murex* s.s.

A classification based on radular morphology is complicated by the sporadic appearance of a drupine-type radula in other thaidine genera, e.g. *Agnewia tritoniformis* (Blainville, 1832) [see Kesteven, 1902, pl. 29, fig. 5 and Cooke, 1919, text fig. 26], *Semiricinula muricina* (Blainville, 1832) [see Arakawa, 1965, pl. 14, figs. 19, 20], and *Neothais smithi* (Brazier, 1889). Wu (1965b) surmized that the distinctive drupine and moruline radula pattern displayed by the species investigated by him may be directly associated with their respective feeding habits.

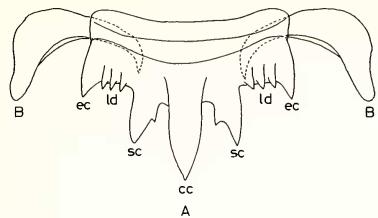


Plate 4. Radula of *Drupa (Drupa) ricinus ricinus* (Linnaeus).
One transverse row. Fig. A. rachidian or central tooth.
Fig. B. lateral tooth.

Abbreviations—
ec, end cusps sc, side cusps
ld, lateral denticles cc, central cusp

Distribution and fossil record

Species of *Drupa* are largely confined in distribution to the Indo-Pacific region, but some range from the northern regions of the Red Sea to Easter, Clipperton and the Galápagos Islands in the eastern Pacific Ocean. They inhabit tropical waters and do not occur beyond latitudes of 35°N and 35°S. Although muricacean gastropods date from the late Mesozoic in the Cretaceous, typical thaid gastropods first appear in the Oligocene in mid-Tertiary (Keen, 1971). These Cenozoic forms apparently are the precursors of the drupine forms that are here referred to *Drupa s.l.* The drupine forms, with low-spired, thaidlike shells having strong labial and columellar teeth, are poorly represented in the fossil record and are known only from the Pleistocene. Fossil moruline forms, with smaller, oval-biconical and higher-spired shells than those of *Drupa s.l.*, are recorded as ranging from the Eocene to the Pleistocene (Eames, 1971, as "*Drupa (Sistrum)*"). The limited paleontological data suggest, therefore, that *Drupa s.l.* and *Morula s.l.* evolved independently from a pre-thaid stock. The fossil evidence is not sufficient, however, to establish a well-documented evolutionary chronology of these generic groups.

As pointed out by Hertlein (1960), Paleogene fossils from Europe and the East Indies have been placed in the genera "*Ricinula*" or "*Sistrum*." A survey of the literature indicates that some of these taxa are not closely allied to *Drupa* or *Morula*. Cossmann (1889, p. 132; 1903, p. 80, pl. 3, fig. 15) refers *Purpura*

ringens Deshayes, 1865, from the Eocene of the Paris Basin to *Ricinula*, a spurious drupine assignment. Another example is *Sistrum baylei* Cossmann & Lambert, (1884, p. 175, pl. 5, fig. 19), from the Oligocene of France; both of these taxa appear to be buccinacean gastropods. *Purpura styriaca* Stur in Hilber, 1879, a Neogene fossil from the Miocene of Hungary, is a thaid, although this taxon was recently referred to *Drupa* by Strausz (1966, p. 284, fig. 130).

Ricinula puruensis Martin (1914, p. 147, pl. 4, fig. 104) [not fig. 105], described from the late Eocene of Java, appears to be the earliest record for the genus *Morula*. Miocene species of *Morula s.l.* include: *M. angسانا* (Martin, 1921, p. 466, pl. 59, fig. 52), *M. turrita* (Martin, 1880, p. 41, pl. 8, fig. 3), both from Java, *M. austriaca* (Hoernes & Auinger, 1882, pl. 16, figs. 14-17) from the Vienna Basin, and *M. inconstans* (Michelotti, 1847, p. 217) from Italy. Neogene fossils that are purported to represent living species of *Morula s.l.* are reported from Mio-Pliocene, Pliocene and Pleistocene deposits in the present Indo-Pacific faunal region and elsewhere.

Drupa s.str. is recorded by Eames (1971) as ranging from the Pliocene to Recent and as occurring in the Red Sea, Indo-Pacific, East Africa and questionably in North America. The New World record is based on the genus *Condona* Hertlein, 1965, (type-species by original designation *Sistrum hawaii* Howe, 1922), from the Pliocene of Oregon and California. This species, however, bears a resemblance to certain buccinacean shells, such as *Cantharus* and *Columbella*, and the monotypic genus *Condona*, therefore appears to be referable to the superfamily Buccinacea instead of the Muricacea.

Pentadactylus rhombiformis Martin (1899, p. 138, pl. 21, figs. 316a, b), described from the Pliocene of Java, was compared with several living muricacean species, including references to Reeve's (1846, *Purpura*, pl. 3, fig. 13) illustration of *Drupa rubusidaeus* Röding. The species was considered closest in relationship to *Purpura muricina* Blainville, and the description and illustration of the Indonesian fossil suggest that it is a spinose thaid.

Thus the available data indicate no valid records for *Drupa s.l.* prior to the Pleistocene. The following species are reported from Pleistocene deposits: *Drupa (Drupa) morum* Röding, 1798; *D. (D.) ricinus ricinus* (Linnaeus,

1758), and *Drupa (Ricinella) rubusidaeus* Röding, 1798 (see distributional records).

Classification

The Linnaean species of *Drupa* s.l. were originally described in the genus *Murex* Linnaeus. Röding (1798) proposed the genus *Drupa*; Montfort (1810) the genus *Sistrum*; and Lamarck (1816) the genus *Ricinula*, all for some of the drupine species previously assigned to *Murex*. The genus-group name *Ricinula* remained in use in malacological literature until about 1913, when it was gradually replaced with Röding's chronologically prior *Drupa*.

Thiele (1929) accepted *Drupa* as a valid genus-group, but relegated several moruline genera, i.e. *Cronia* H. & A. Adams, *Morulina* Dall (= *Azumamorula* Emerson), *Phrygiomurex* Dall, *Maculotriton* Dall and *Drupella* Thiele, as subgenera of *Drupa*. Wenz (1941) erected the new subfamily Drupinae, which besides the type-genus *Drupa*, contained the genus *Thais* Röding and other thaïd genera, together with the non-thaïd genus *Tritonalia* Fleming (= *Ocenebra* Gray). Drupinae Wenz, 1938 and 1941 is presently considered a junior synonym of Thaidinae Suter, 1909 (as Thaididae Suter, 1909, Rec. Canterbury Mus., vol. 1, p. 11; 1909, Subantarctic Islands of New Zealand, art. 1, p. 27). The subfamilial name Thaidinae was conserved by action of the International Commission on Zoological Nomenclature (Opinion 886, 1969) in preference to the chronologically older, but less frequently used Purpurinae.

Species of *Drupa* are here assigned to the genus mainly on shell-morphology, although radular characters have also been considered. As pointed out in the section on "Radulæ," a classification on radular characters alone would require an inclusion of species of *Agnewia*, *Semiricinula*, *Neothais* and a species of *Morula*. Such a classification was in fact proposed by Cooke (1919), who included 7 non-drupine species in *Drupa* on the basis of radular characters which he considered "distinctly of the *Drupa* type." It is obvious that on shell-morphology alone, the limits of *Drupa* are well-defined, but radular characters of *Drupa* also appear rarely in species referable to other thaïdine genera.

Due to the dispersal at auction of the Bolten collection, on whose specimens Röding's new

descriptions were based, the whereabouts of the type-specimens are no longer known. F. C. Schmidt did purchase a small part of Bolten's collection in 1819, but in a letter written by him, he observed that a great amount of the collection was purchased by Hamburg buyers. From those specimens procured by Schmidt from the Bolten collection, now in the Naturkundemuseum, Staatliche Museen zu Gotha, Germany, only very few can be traced back to Bolten (Dr. Motschmann, *in litt.*). In the absence of Röding's type-specimens we have designated appropriate cited illustrations of specimens figured by other authors as lectotypes of Röding's species.

List of Recognized Taxa

Below are listed the recognized generic and specific taxa for the genus *Drupa*. The eleven species and subspecies are referred to three genus-groups. All are living, and three are also recorded as Pleistocene fossils.

Family Muricidae Rafinesque, 1815

Subfamily Thaidinae Suter, 1909

GENUS *Drupa* Röding, 1798

Subgenus *Drupa* Röding, 1798

morum *morum* Röding, 1798. Type species.

Recent. Indo-Pacific and Eastern Pacific, except the Marquesas Islands. Pleistocene.

morum *iodostoma* (Lesson, 1840). Recent, Marquesas Islands.

ricinus *ricinus* (Linnaeus, 1758). Recent, Indo-Pacific and Eastern Pacific. Pleistocene.

ricinus *hadari* Emerson and Cernohorsky, new subspecies. Recent, Red Sea.

elegans (Broderip and Sowerby, 1829). Recent, Wake Island to the Tuamoto Islands.

Subgenus *Ricinella* Schumacher, 1817

rubusidaeus Röding, 1798. Type species. Recent, Indo-Pacific. Pleistocene.

speciosa (Dunker, 1867). Recent, Tuamoto and Pitcairn Islands.

clathrata *clathrata* (Lamarck, 1816). Recent, tropical west Pacific Ocean.

clathrata *miticula* (Lamarck, 1822). Recent, Indian Ocean.

Subgenus *Drupina* Dall, 1923

grossularia Röding, 1798. Type species. Recent, East Indian Ocean and Pacific.

lobata (Blainville, 1832). Recent, Indian Ocean.

Abbreviations

The following institutional abbreviations are used in this paper:

AIM—Auckland Institute and Museum, Auckland

AMNH—American Museum of Natural History, New York

AMS—Australian Museum, Sydney

ANSP—Academy of Natural Sciences of Philadelphia

BM (NH)—British Museum (Natural History), London

BPMB—Bernice P. Bishop Museum, Honolulu

DM—Dominion Museum, Wellington

DMNH—Delaware Museum of Natural History, Greenville

FMNH—Field Museum of Natural History, Chicago

MCZ—Museum of Comparative Zoology, Cambridge, Massachusetts

LACMH—Los Angeles County Museum of Natural History

MHNG—Musée d'Histoire Naturelle, Geneva

SDMNH—San Diego Museum of Natural History

USNM—National Museum of Natural History, Washington, D.C.

WAM—Western Australian Museum, Perth

Acknowledgments

We gratefully acknowledge the help extended to us in providing access to collections, technical assistance, loan of specimens, field data and information on types. We would like to thank the following persons:

R. T. Abbott—DMNH; E. Binder—MHNG; W. J. Clench and R. D. Turner—MCZ; S. P. Dance, National Museum of Wales, Cardiff; R. K. Dell—DM; the late A. Hadar, Tel Aviv, Israel; E. A. Kay, University of Hawaii, Honolulu; J. Knudsen, University Zoological Museum, Copenhagen; Y. Kondo—BPBM; Fei-Jann Lin, Academia Sinica, Taipei, Taiwan; J. H. McLean—LACMH; D. F. McMichael—formerly AMS; D. Motschmann, Naturkundemuseum, Gotha; W. E. Old, Jr.—AMNH; V. Orr Maes—ANSP; A. W. B. Powell—AIM; H. A. Rehder, J. Rosewater and J. P. E. Morrison—USNM; G. E. Radwin—SDMNH; Mme. P. Revercé, Nouméa, New Caledonia; M. G. Richards—formerly AMNH; B. Salvat, Muséum National d'Histoire Naturelle, Paris; V. Siewersten, Koloa, Hawaii; A. Solem—FMNH; Mr. & Mrs. G. D. Stout,

New York; J. B. Taylor, Prescott College, Arizona; J. Taylor and K. Way—BM (NH); N. Tebble, Oxford University Museum; J. J. Wageman, Koloa, Hawaii; C. S. Weaver, Kailua, Hawaii; B. R. Wilson and S. M. Slack-Smith—WAM; Shi-Kuei Wu, University of Michigan, Ann Arbor.

Species excluded from Drupa

Included under this heading are species of Thaidinae which were originally described in *Drupa*, or have been referred to this genus by subsequent authors. In the latter category, only those species requiring further explanation have been listed.

Neothais bollonsi (Suter, 1906)

(Pls. 5, 6)

Remarks—Suter (1909) assigned this moruline species to the genus *Drupa* on the basis of the typically drupine radula. Iredale (1915) correctly synonymized *D. bollonsi* with the southeast Australian species *Purpura smithi* Brazier, 1889, and assigned it to the genus *Neothais* Iredale, 1912. Despite its drupine radular characters, the species should be placed near *Morula* Schumacher.



0.1 mm

Plate 5. Radula of *Neothais smithi* (Brazier). Half a transverse row; Sunday Id., Kermadec Ids. [synonym is *Drupa bollonsi* Suter].

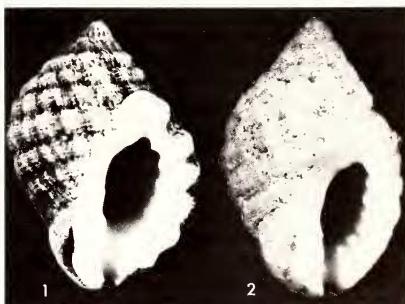


Plate 6. *Neothais smithi* (Brazier). [synonym is *Drupa bollonsi* Suter].

Fig. 1 Sunday Id., Kermadec Ids. (AIM; 24.5 x 17.4 mm).

Fig. 2 Norfolk Id. (AIM; 18.0 x 12.0 mm).

Synonymy—

- 1899 *Purpura smithi* Brazier, Australian Museum Memoir, no. 2, p. 28, pl. 4, figs. 1-4, 7-12, 21-22 (Lord Howe Id.) [as *Purpura (Polytropa) smithi* on plate explanation].
- 1902 *Purpura tritoniformis* var. *smithi* Brazier, Kesteven, Proceedings of the Linnaean Society of New South Wales, pt. 4, p. 534.
- 1906 *Purpura striata* Martyn subsp. *bollensi* Suter, Transactions and Proceedings New Zealand Institute, vol. 38, p. 331 (Kermadec Ids.).
- 1909 *Drupa bollensi* Suter, Proceedings of the Malacological Society of London, vol. 8, p. 254, pl. 11, figs. 5-7 (shell, operculum and radula); 1913 Suter, Manual of the New Zealand Mollusca, p. 428, pl. 19, fig. 11 (New Zealand).
- 1915 *Neothais smithi* (Brazier), Iredale, Transactions and Proceedings New Zealand Institute, vol. 47, pp. 474, 475; 1915 Oliver, Transactions and Proceedings New Zealand Institute, vol. 47, p. 536; 1950 Dell, Dominion Museum Records, Zoology, vol. 1, no. 3, p. 26.

Condonia hannai (Howe, 1922)

Remarks—This moderately large, (66.8 mm long) species from the Pliocene of Oregon and California was originally described in the genus *Sistrum* Montfort. Hertlein (1965) proposed for this species the new genus *Condonia*, and placed the genus in the muricid subfamily "Drupinae" with apparent reluctance. He concluded that: "*Condonia hannai* bears a general resemblance to the Recent *Drupa iodostoma* Lesson . . . but the spire of that species is low and the columella [=error for inner margin of outer lip] bears denticles typical of *Drupa*." He also noted that the genus was not known as a fossil in the Eastern Pacific region, but that living representatives occur in the Galápagos Islands and at Clipperton Island. Although the labial dentition does superficially resemble that of *Drupa*, the type-species of *Condonia* lacks columellar denticles. This extinct species appears to be a buccinacean gastropod, and Dr. G. E. Radwin (*in litt.*) considers *Condonia hannai* to be an extralimital representative of the genus *Columbella* s.str. which, perhaps due to its unusual northern, cooler-water habitat, attained a giant size. The monotypic genus *Condonia*, therefore, appears to be referable to the Buccinacea rather than the Muricacea.

Synonymy—

- 1922 *Sistrum hannai* Howe, Univ. California Publ., Bull. Dept. Geol. Sci., vol. 14, no. 3, p. 102, pl. 8, figs. 1-5 (Fossil Point, S. W. Empire City, Coos Bay, Pliocene of Oregon); 1943 Weaver, Univ. Washington Publ. Geology, vol. 5, pt. 2, p. 450, pl. 87, figs. 14,

16 (figured holotype); 1960 Hertlein, Veliger, vol. 3, no. 1, p. 8 (San Benito County, Pliocene of California).

- 1965 *Condonia hannai* (Howe), Hertlein, Occas. Papers California Acad. Sciences no. 49, p. 4, figs. 3, 4 (figured holotype).

Azumamorula mutica (Lamarck, 1816)

(Pls. 7, 8)

Remarks—For the western Indian Ocean species *Ricinula mutica* Lamarck, which is intermediate in shell-characters between *Drupa* Röding, and *Morula* Schumacher, Dall (1923) proposed the genus-group *Morulina*. Thiele (1929) and Wenz (1941) assigned *Morulina* as a subgenus to *Drupa*. Emerson (1968) proposed the substitute name *Azumamorula* for the preoccupied *Morulina* Dall (non *Morulina* Börner, 1906, in Insecta), and figured the radula of the type-species, which is typically moruline.



Plate 7. Radula of *Azumamorula mutica* (Lamarck). Half a transverse row; Black River Bay, Mauritius (after Azuma and d'Attilio in Emerson, 1968).

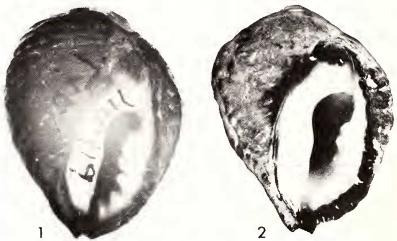


Plate 8. *Azumamorula mutica* (Lamarck). Fig. 1. Holotype from unknown locality ("Mozambique" on label) [MHNG no. 1101/19; 20.2 x 16.5 mm].

Synonymy—

- 1816 *Ricinula mutica* Lamarck, Tabl. Encycl. Méthodique, p. 1, pl. 395, figs. 2a, b (no locality given); 1846 Reeve, Conchologia Iconica, vol. 3, pl. 2, fig. 1.
- 1822 *Ricinula pisolina* Lamarck, Hist. nat. anim. s. vertébrés, vol. 7, p. 233 (Île de France - Mauritius); 1835 Kiener, Spéc. gén. icon. coquilles vivantes, vol. 8, p. 20, pl. 4, fig. 8a (juvenile specimen); 1844 Deshayes and Milne-Edwards, Hist. Nat. anim. s. vertébrés, ed. 2, vol. 10, p. 52.
- 1919 *Morula mutica* (Lamarck). Cooke, Proceedings of the Malacological Society of London, vol. 13, p. 106 (description of radula).

- 1923 *Morulina mutica* Lamarck, Dall, Proceedings of the Academy of Natural Sciences of Philadelphia, vol. 75, p. 303.
- 1929 *Drupa (Morulina) mutica* (Lamarck), Thiele, Handb. syst. Weichtierkunde, vol. 1, p. 294; 1941 Wenz, Handb. Paläozoologie, vol. 6, pt. 5, p. 1112, text fig. 3159.
- 1968 *Azumamorula mutica* (Lamarck), Emerson, Nautilus, vol. 81, no. 4, p. 125, text fig. (radula).

**Drupa vitiensis Pilsbry in
Pilsbry and Bryan, 1918**

Remarks—The species illustrated by Pilsbry and Bryan is the male form of *Drupella cornus* (Röding, 1798). Generally credited to Pilsbry, 1921, the specific name was validated by Pilsbry and Bryan through a published illustration in combination with a specific name.

Synonymy—

- 1918 *Drupa vitiensis* Pilsbry in Pilsbry & Bryan, Nautilus, vol. 31, no. 3, pl. 9, fig. 5.
- 1921 *Sistrum vitiense* Pilsbry, Proceedings of the Academy of Natural Sciences of Philadelphia, vol. 72, p. 319 (Fiji Ids.).

Drupa walkerae Pilsbry and Bryan, 1918

Remarks—The species described by the authors belongs to *Drupella* Thiele, 1925, and is similar to, if not conspecific with *D. rugosa* (Born, 1778).

Synonymy—

- 1918 *Drupa walkerae* Pilsbry & Bryan, Nautilus, vol. 31, no. 3, p. 99, pl. 9, fig. 4 (Honolulu Harbor, Hawaiian Ids.).

Röding (1798) described in the *Museum Boltianum*, pp. 55-56, the following *Drupa* species: *D. chamaemorus*, *D. botroides*, *D. uva*, *D. cornus*, *D. glans*, *D. muricina*, *D. mancinella*, *D. trapa* and *D. aesculus*. All these taxa are nondrupine species referable to various thaidine genera, with the exception of *D. glans*, which belongs to the genus *Astrofusus* Kobelt, 1879, in the family Buccinidae.

Selected Bibliography

- Abbott, R. Tucker 1958. Marine Mollusca of Rennell Island, Solomon Islands. The Natural History of Rennell Island, British Solomon Islands. Copenhagen, vol. 2, pp. 203-206.
- Adam, W. and E. Leloup. 1938. Resultats Scientifiques du voyage aux Indes Orientales Néerlandaises. Prosobranchia et Opisthobranchia. Mémoires du Musée Royal d'Historie Naturelle de Belgique, vol. 2, fasc. 19, pp. 1-209, pls. 1-8.
- Adams, F. 1967. *Drupa grossularia* Röding. Hawaiian Shell News, vol. 15, no. 8, p. 4.
- Allan, J. 1959. Australian Shells. Revised edition. Melbourne, 487 pp., pls., text figs.
- Altena, C. O. v. R. 1945. Report upon a recent collection of shells from Java. Zoologische Mededelingen, Leiden, vol. 25, pp. 155-199.
- Arakawa, K. Y. 1965. A study on the radulae of the Japanese Muricidae (3). Venus: Japanese Journal of Malacology, vol. 24, no. 2, pp. 113-126, pls. 13-14.
- Boettger, C. R. 1918. Die Mollusken-ausbeute der Hanseatischen Süddsee-Expedition 1909. Abhandlungen Senckengesellschaft, vol. 36, Heft 3, pp. 285-308, pls. 21-23.
- Cernohorsky, W. O. 1969. The Muricidae of Fiji. Part II—Subfamily Thaidinae. The Veliger, vol. 11, no. 4, pp. 293-315, pls. 47-49, text figs.
- Chamberlain, J. L. 1960. Voygae of the Venus. The Nautilus, vol. 74, no. 2, pp. 65-68.
- Children, J. G. 1823. Lamarc's Genera of Shells. Quart. Journal Sci. Lit. and Arts, vol. 16, pp. 49-79, pl. 5.
- Cooke, A. H. 1919. The radula in *Thais*, *Drupa*, *Morula*, *Concholepas*, *Cronia*, *Iopas* and the allied genera. Proceedings of the Malacological Society of London, vol. 13, pt. 4, pp. 90-110, 38 text figs.
- Cossmann, M. 1889. Catalogue illustré des coquilles fossiles de l'Éocène des environs de Paris. Annales de la Société Royale Malacologique de Belgique, vol. 29, fasc. 4, 385 pp., 12 pls.
- Cossmann, M. 1903. Essais de paléoconchologie comparée. Paris, livr. 5, 215 pp., 9 pls.
- Cossmann, M. and J. Lambert. 1884. Pt. 1, Étude paléontologique et stratigraphique sur le terrain Oligocène marin aux environs d'Étampes. Mémoires de la Société Géologique de France, ser. 3, vol. 3, 187 pp., 6 pls.
- Couturier, M. 1907. Étude sur les Mollusques Gastropodes recueillis par M. L.-G. Seurat dans les archipels de Tahiti, Paumotu et Gambier. Journal de Conchyliologie, vol. 55, pp. 123-178.
- Cox, L. R. 1927. Report on the Palaeontology of the Zanzibar Protectorate. Mollusca, pp. 13-180, pls. 3-19.
- Cox, L. R. 1930. Reports on geological collections from the coastlands of Kenya Colony. VII. Post Pliocene Mollusca. Monograph 4 of the Geological Department of the Hunterian Museum, Glasgow, pp. 131-163.
- Cox, L. R. 1939. Depósitos terciários e post-pliocenos do distrito de Inhamane. Estudo paleontológico das respectivas faunas de Molluscos. Servicos de Indústria, Minas e Geologia, Loreno Marques, Boletim No. 3, pp. 65-103.
- Dance, S. P. 1966. Shell Collecting. An Illustrated History. University of California Press, 344 pp., plates.
- Dautzenberg, P. and J.-L. Bouge. 1933. Les mollusques testacés marins des établissements français de l'Océanie. Journal de Conchyliologie, vol. 77, pp. 145-326.
- Demond, J. 1957. Micronesia Reef-associated Gastropods. Pacific Science, vol. 11, no. 3, pp. 275-341, text figs.
- Deshayes, G. P. 1863. Catalogue des Mollusques de l'Île de la Réunion (Bourbon). Revue des deux Mondes, Paris, pp. 1-44.
- Dietrich, R. V. and P. A. Morris. 1953. Mollusks from Kwajalein. The Nautilus, vol. 67, no. 1, pp. 13-18, pl. 4, text figs.
- Dodge, H. 1957. A historical review of the Molluscs of Linnaeus. Part 5. The genus *Murex* of the Class Gastropoda. Bulletin American Museum of Natural History, vol. 113, art. 2, pp. 77-223.
- Eames, F. E. in A. M. Davis. 1971. Tertiary Faunas. A textbook for oilfield paleontologists and students of geology. Vol. 1. The composition of Tertiary faunas (revised edition). New York, American Elsevier Publ. Co. Inc., 571 pp.
- Emerson, W. K. 1968. *Azumonorula*, new name for *Morulina* Dall, 1923, not Boerner, 1906 (Gastropoda: Muricaceae). The Nautilus, vol. 81, no. 4, pp. 125-127, text fig.
- Fischer, P. H. 1891. Catalogue of Indo-Chinese species. Société d'Histoire Naturelle d'Autun, vol. 4, pp. 87-276.
- Fischer, P. H. and E. Fischer-Piette. 1940. Gastropods marins recueillis aux Nouvelles Hebrides par M. E. Aubert de la Rue. Bulletin Muséum d'Histoire Naturelle, Paris, vol. 11, no. 2, pp. 263-266.
- Franc, A. 1956. Résultats scientifiques des campagnes de la Calypso. II. Campagne 1951-1952 en Mer Rouge. IX. Mollusques marins. Annales de l'Institut Océanographique de Monaco, N.S., vol. 32, pp. 19-60.
- Hedley, C. 1899. The Mollusca of Funafuti. Part I- Gastropoda. Memoirs of the Australian Museum, vol. 3, pt. 7, pp. 397-488, 49 text figs.
- Hedley, C. 1903. Notes on the zoology of Paanopa or Ocean Island and Nauru or Pleasant Island, Gilbert Group. The Mollusca. Records of the Australian Museum, vol. 5, no. 1, pp. 4-5.
- Hedley, C. 1913. On the nomenclature of *Drupa*. The Nautilus, vol. 27, no. 7, pp. 79-80.
- Heincke, H.-H. 1970. Shelling Safari to Kenya. Hawaiian Shell News, vol. 18, no. 7, pp. 6-7.
- Hertlein, L. G. 1960. The subfamily Drupinae (Gastropoda) in the Eastern Pacific. The Veliger, vol. 3, no. 1, pp. 7-8.
- Hertlein, L. G. 1965. A new genus of gastropod (Drupinae) from the Pliocene of Oregon and California. Occasional Papers, California Academy of Sciences, no. 49, pp. 1-5, 4 figs.
- Hertlein, L. G. and E. C. Allison. 1960. Gastropods from Clipperton Island. The Veliger, vol. 3, pt. 1, pp. 13-16.
- Hoernes, R. and M. Auinger. 1882. Die Casteropoden der Meeres-Ablagerungen der ersten und zweiten Miocänen Mediterran-Stufe in der österreichisch ungarischen Monarchie. Abhandlungen k.k. Geologischen Reichs-Anstalt, Wien, vol. 12, Heft 3, pp. 113-152, pls. 13-16.
- Hornell, L. 1922. The common molluscs of South India and Appendix (Molluscan fauna of the Laccadive Islands). Madras Fisheries Bulletin, no. 6, pp. 97-215.
- Iredale, T. 1915. A commentary on Suter's "Manual of the New Zealand Mollusca." Transactions and Proceedings of the New Zealand Institute, vol. 47, pp. 417-497.
- Iredale, T. 1937. Middleton and Elizabeth reefs, South Pacific Ocean. Mollusca. Australian Zoologist, vol. 8, pt. 4, pp. 232-261, pls. 15-17.
- Iredale, T. and D. F. McMichael. 1962. A reference List of the marine Molluscs of New South Wales. The Australian Museum Memoir, no. 11, 109 pp.
- Kay, E. A. 1971. The littoral marine molluscs of Fanning Island. Pacific Science, vol. 25, no. 2, pp. 260-281, 15 text figs.
- Keen, A. M. 1971. A review of the Muricaceae. The Echo, Abstr. and Proc. 4th Ann. Meeting West. Soc. Malacologists, no. 4, pp. 35-36.

- Kesteven, H. L. 1902. The systematic position of *Purpura tritoniformis* of Blainville. Proceedings of the Linnean Society of New South Wales, pt. 4, pp. 533-538, pl. 29.
- Kosuge, S. 1969. Fossil mollusks of Oahu, Hawaiian Islands. Bulletin of the National Science Museum, Tokyo, vol. 12, no. 4, pp. 783-794, 7 pls.
- Kuroda, T. 1941. A catalogue of molluscan shells from Taiwan, with descriptions of new species. Memoirs of the Faculty of Science and Agriculture, Tohoku Imperial University, vol. 22, no. 4, pp. 65-216.
- Lamy, E. 1938. Mission Robert Ph. Doflus en Égypte. VII. Mollusca Testacea. Mémoires de l'Institut d'Égypte, vol. 37, pp. 1-89.
- Langdon, A. W. 1875. Shells of Ceylon. Quarterly Journal of Conchology, vol. 1, pp. 71-78.
- Mansfield, W. C. in H. T. Stearns and K. N. Vaksvik. 1935. Geology and Ground-Water resources of the Island of Oahu, Hawaii. Territory of Hawaii, Division of Hydrography Bulletin, 1, pp. 166-168.
- Martin, K. 1880. Die Tertiärschichten auf Java. Leiden, pp. 1-164, pls. 1-28, 1 map.
- Martin, K. 1899. Die Fossilen von Java. Mollusken. Parts 5-7. Samml. geol. Reichs-Museums Leiden, N.F., vol. 1, Abt. 1. Heft 6-8, pp. 133-221, pls. 21-33.
- Martin, K. 1914. Die Fauna des Oberocäns von Nanggulan, auf Java. A. Gastropoda. Samml. geol. Reichs-Museums Leiden, N.F., vol. 2, Abt. 2, Heft 5, pp. 107-178, pls. 1-6.
- Martin, K. 1921. Die Fossilen von Java. Die Mollusken der Njaldungschichten. Samml. geol. Reichs-Museums Leiden, N.F., vol. 1, Abt. 2, Heft 3-4, pp. 416-496, pls. 58-71.
- Melvill, J. C. 1909. Report on the marine Mollusca obtained by Mr. J. Stanley Gardiner, F.R.S. among the islands of the Indian Ocean in 1905. Transactions of the Linnean Society of London, ser. 2, Zoology, vol. 13, pt. 1, pp. 65-138.
- Melvill, J. C. and E. R. Sykes, 1899. Notes on a third collection of marine shells from the Andaman Islands, with description of three new species of *Mitra*. Proceedings of the Malacological Society of London, vol. 3, pp. 220-229.
- Melvill, J. C. and R. Standen. 1898. Report on the marine Mollusca obtained in Torres Strait. Journal of the Linnean Society of London, vol. 27, pp. 150-206.
- Micheletti, G. 1847. Description des fossiles des Terrains Miocènes de l'Italie septentrionale. Naturkundige Verhandelingen Hollandsche Maatschappij der Wetenschappen, Haarlem, ser. 2, vol. 3, no. 2, 408 pp., 17 pls.
- Ostergaard, J. M. 1928. Fossil marine Molluscs of Oahu. Bernice P. Bishop Museum Bulletin, no. 51, pp. 1-32.
- Rees, W. J. and A. Stuckley. 1952. The Manihine Expedition to the Gulf of Aqaba. VI Mollusca. Bulletin of the British Museum (Natural History), Zoology I, pp. 183-201.
- Reeve, L. A. 1846. Conchologia Iconica. Monograph of the genus *Purpura*. London, vol. 3, 13 pls., plus text and Index.
- Salvat, B. 1970. Études quantitatives (comptages et biomasses) sur les Mollusques récifaux de l'Atoll de Fangataufa (Tuamotu-Polynésie). Cahiers du Pacifique, no. 14, pp. 1-58, pls. 1-5.
- Satyanarati, S. T. 1952. The Mollusca of Krusadai Island (in the Gulf of Manaar). I. Amphineura and Gastropoda. Bulletin of the Madras Government Museum, N. S., Natural Hist. section, vol. 1, no. 2, pt. 6, pp. 1-266, pls. 1-33.
- Shirley, J. 1912. Additions to the marine Mollusca of Queensland. Proceedings of the Royal Society of Queensland, vol. 23, pp. 93-102.
- Shopland, E. R. 1896. List of shells collected at Aden in 1892-1895, classified in accordance with the Paetel catalogue. Journal of the Bombay Natural History Society, vol. 10, pp. 217-235.
- Smith, E. A. 1897. Notes on some type-specimens in the British Museum. Proceedings of the Malacological Society of London, vol. 2, pp. 229-232.
- Solem, A. 1959. Marine Mollusca of the New Hebrides. Pacific Science, vol. 13, pp. 253-268.
- Steele, P. H. 1957. Easter Island Shells. The Nautilus, vol. 70, no. 4, pp. 111-113.
- Stockley, G. M. 1928. Report on the geology of the Zanzibar Protectorate. London, 126 pp.
- Strausz, L. 1966. Die Miozän-Mediterranen Gastropoden Ungarns. Budapest, 694 pp., 79 pls., 221 figs.
- Stur, D. in V. Hilber. 1879. Neue Conchylien aus den mittelsteirischen Mediterranenschichten. Sitzungsberichte Akademie Wissensch. Wien, Math.-Naturw. Classe, vol. 79, Abt. 1, Heft 5, pp. 416-464, pls. 1-6.
- Sturany, R. 1905. Beiträge zur Kenntnis der Molluskenfauna des Roten Meeres und des Golfs von Aden. Nachrichtenblatt der deutschen Malakozoologischen Gesellschaft, pp. 132-146.
- Taylor, J. D. 1968. Coral reef and associated invertebrate communities (mainly molluscan) around Mahé, Seychelles. Philosophical Transactions of the Royal Society of London, Biological Sciences, ser. B, vol. 254, pp. 129-206, pls. 13-17, text figs.
- Tomlin, J. R. le B. 1934. The marine Mollusca of Christmas Island, Indian Ocean. Bulletin Raffles Museum, Singapore, vol. 9, pp. 74-84.
- Wilson, B. R. and K. Gillett. 1971. Australian Shells. A. II. & A. W. Reed, Sydney, 168 pp., 106 pls., text figs.
- Wu, S.-K. 1965a. Studies of the radulae of Taiwan muricid Gastropods. Bulletin Institute Zoology, Academia Sinica, vol. 4, pp. 95-106, 35 text figs.
- Wu, S.-K. 1965b. Comparative functional studies of the digestive system of the muricid gastropods *Drupa ricina* and *Morula granulata*. Malacologia, vol. 3, no. 2, pp. 211-233, pls. 1-5.

About the authors



Walter O. Cernohorsky has been a malacologist and the Curator of Molluscs at the Auckland Institute and Museum, Auckland, New Zealand, since 1969. Born in Czechoslovakia on June 30, 1927, he emigrated to Fiji in the 1950's where he was Chief Surveyor for the Emperor Gold Mining Company and served as Honorary Conchologist at the Fiji Museum. In 1968, he received a senior post-doctoral Research Associateship with the Smithsonian Institution, Washington, D. C. He is author of numerous scientific papers on the marine mollusks of the Indo-Pacific, especially those of the families Mitridae, Muricidae and Strombidae. His contributions have appeared in *The Nautilus*, *The Veliger*, the *Bulletin of the Auckland Institute and Museum*, and the *Revue Suisse de Zoologie*. In 1967 and 1972 he authored two volumes for amateurs entitled, *Marine Shells of the Pacific*. Mr. Cernohorsky is an accomplished photographer, an active field collector, is married, and has two children.



Dr. William K. Emerson is Curator of Mollusks and Chairman of the Department of Living Invertebrates at the American Museum of Natural History, New York City. His research interests concern taxonomy and zoogeography of late Cenozoic marine mollusks, especially gastropods and scaphopods. He has participated in several expeditions to west Mexico and the Caribbean region. A native of California, Dr. Emerson was born in San Diego on May 1, 1925, and earned degrees in zoology from the California State University at San Diego (A.B. 1948) and the University of Southern California, Los Angeles (M.S. 1950). From 1951 to 1955, he served as Museum Paleontologist at the University of California, Berkeley, where he received a Ph.D. in invertebrate paleontology in 1956. He joined the staff of the American Museum in 1955. Dr. Emerson is the author of numerous scientific articles and is co-author of three books designed to assist amateurs. He is a past president of the American Malacological Union and of the Western Society of Malacologists.

Family Muricidae Rafinesque, 1815

Subfamily Thaidinae Suter, 1909

Key To Subgeneric Groups of Indo-Pacific Drupa

- A. Columella singularly folded axially B
- B. Labial teeth compound,
constricting the aperture *Drupa s.str.* p. 14-819
- BB. Labial teeth singularly arranged or
occasionally in close association, not compound,
aperture not constricted *Ricinella* p. 14-841
- AA. Columella doubly folded axially; margin of outer lip
with 2 digitate processes, aperture narrow,
not constricted *Drupina* p. 14-859

Subfamily Thaidinae Suter, 1909

The subfamily name Thaidinae has been granted precedence over the long established family-group name Purpuridae Menke, 1828, in Opinion 886 of the International Commission on Zoological Nomenclature. Although the Commission has dated Thaidinae Suter from 1913, Suter erected the family-group name in 2 prior publications in 1909 (see synonymy).

Authors generally divide the family Muricidae into 7 subfamilies: the Muricinae, Ocenebrinae, Aspellinae, Thaidinae, Trophoninae, Typhinae and Rapaninae. Some authors, however, consider the Thaidinae worthy of family rank, but since no scientific evidence as to important anatomical, morphological or ecological differences between the Thaidinae and other closely related muricid groups has been presented, an elevation of Thaidinae to family rank appears unwarranted. In such a closely related species-group as the Muricidae, with numerous existing species of intermediate generic characters, a taxonomic consolidation rather than further subdivision, is indicated.

Apart from the nominate type-genus *Thais* Röding, 1798, the subfamily Thaidinae contains such genera as *Mancinella* Link, 1807, *Acanthina* Fischer von Waldheim, 1807, *Cymia* Mörcz, 1860, *Purpura* Bruguière, 1789, *Nucella* Röding, 1798, *Nassa* Röding, 1798, *Vexilla* Swainson, 1840, *Pinaxia* H. & A. Adams, 1853, *Xanthochorus* Fischer, 1888, *Morula* Schumacher, 1817, *Azumamorula* Emerson, 1968, *Drupella* Thiele, 1925, *Neothais* Iredale, 1912, *Lepsiella* Iredale, 1912, *Agnewia* Tenison-Woods, 1878, *Cronia* H. & A. Adams, 1853, and other subgeneric groups and fossil genera.

Synonymy—

- 1828 *Purpuracea* Menke, Synopsis methodica Molluscorum, p. 34 (suppressed by the ICZN in Opinion 886, 1969, Bull. zool. Nomenclature, vol. 26, pp. 128-132).
- 1839 *Purpuridae* Broderip, Penny Cyclop., vol. 14, p. 321 (suppressed in Opinion 886 of ICZN).
- 1840 *Purpurinae* Swainson, Treatise on Malacology, p. 71 (suppressed in Opinion 886 of ICZN).
- 1909 *Thaisidae* Suter, Records Canterbury Museum, vol. 1, p. 11; 1909 Suter, Subantarctic Islands of New Zealand, art. 1, p. 27.
- 1938 *Drupinae* Wenz, Handbuch der Palaeozoologie, vol. 6, pt. 1, pp. 42, 47; 1941 Wenz, *ibid.*, pt. 3, p. 1112.

Subfamily Thaidinae Suter, 1909

Genus *Drupa* Röding, 1798

Type: *Drupa morum* Röding, 1798

On shell characters, the group generally considered as belonging to *Drupa* s.str. can be divided into two distinct groups. In the group of the type-species *Drupa morum* Röding, which also includes the subspecies *D. morum iodostoma* (Lesson), *D. ricinus* (Linnaeus) and *D. elegans* (Broderip & Sowerby), the majority of the denticles on the outer lip are arranged as compound, i.e. bifid or trifid teeth which constrict the aperture posteriorly. In the group comprising *D. rubusidacaeus* Röding, *D. speciosa* (Dunker) and *D. clathrata* (Lamarck), the denticles of the outer lip are singularly situated as non-compound teeth, which results in an appreciably wider aperture. For this group of species the subgeneric name *Ricinella* Schumacher, 1817, is available. Although the teeth on the outer lip of *Drupa* (*Drupina*) *grossularia* Röding, the type-species of the subgenus *Drupina* Dall, are also singularly arranged, the shell of the species develops marginal lobate processes and the radula has a greatly modified rachidian radular tooth and very slender and small lateral teeth.

Drupa differs from *Morula* in having a more sub-ovate form, lower spire, longer aperture and a structurally different central radular tooth. Members of *Drupa* show a close radular relationship with most of the thaidine groups.



Plate 9. Type-species of subgenera of *Drupa* Röding.

Fig. 1. *Drupa* (*Drupa*) *morum* Röding, Namouï reef, Niue Id. (WOC coll.; 29.8 x 27.4 mm).

Synonymy—

- 1798 *Drupa* Röding, Museum Boltenianum, p. 55. Type-species by subsequent designation, Rovereto, 1899: *Drupa morum* Röding, 1798.
 1807 *Canrena* Link, Beschr. Nat.-Sammel. Univ. Rostock, p. 126. Type-species by monotypy: *Canrena neritoidea* Link, 1807 [= *Drupa morum* Röding, 1798] (as restricted by Iredale, 1937, and lectotype designation by Cernohorsky, 1969).
 1810 *Sistrum* Montfort, Conchyliologie systématique, vol. 2, p. 595. Type-species by original designation: *Sistrum album* Montfort, 1810 [= *Drupa ricinus* (Linnaeus, 1758)].
 1816 *Ricinula* Lamarck, Tableau Encyclopédique et Méthodique, p. 1. Type-species by subsequent designation, Children, 1823: *Ricinula horrida* (= *R. horrida* Lamarck) [= *Drupa morum* Röding, 1798].
 1822 "Ricinella Lam.", Bowdich, Elements of Conchology, vol. 1, p. 40. [? error for *Ricinula* Lamarck, 1816] (sole species listed and figured *Ricinula horrida* Lamarck, 1816) [non *Ricinella* Schumacher, 1816].
 1852 *Pentadactylus* Mörsch, Catal. Conchyl. Yoldi, vol. 1, p. 87. Type-species by subsequent designation, Baker, 1895: *Pentadactylus ricinus* Lamarck = *Drupa ricinus* (Linnaeus, 1758). [non *Pentadactylus* Schultze, 1760, in Echinodermata; nec Gray, 1845, in Reptilia].
 1855 *Ricinula* Gould, U.S. Astronom. Exp. South. Hemisphere, vol. 2, p. 263 (error for *Ricinula* Lamarck, 1816).
 1859 *Ricinulus* Demarest in Chenu, Encycl. Hist. Nat. Crust. Moll. Zooph., p. 174 (invalid emendation for *Ricinula* Lamarck, 1816).

As pointed out by the junior author (Cernohorsky, 1969), Suter (1913) is credited by Dodge (1957) and other authors with the type designation of *Drupa*, but Rovereto's (1899) designation is earlier.

Although members of this genus were placed until the turn of the present century in Lamarck's *Ricinula*, there were available

Fig. 2. *Drupa* (*Ricinella*) *rubusidacaeus* Röding, Suva reef, Fiji Ids. (WOC coll.; 40.5 x 36.5 mm).

Fig. 3. *Drupa* (*Drupina*) *grossularia* Röding, Pango Point, Efate Id., New Hebrides (WOC coll.; 28.3 x 28.6 mm).

three valid prior generic names, of which *Drupa* Röding, 1798, is the oldest. Link, 1807, established *Canrena* as a monotypic genus with *Canrena neritoidea* Link, the sole species. His citation to Martini's figures include the species *Drupa ricinus* (Linnaeus), *D. morum* Röding, and *D. grossularia* Röding. *Canrena neritoidea* was restricted by Iredale (1937) to *Drupa morum* Röding, as depicted by Martini's figures 972, 973, on plate 101. The same figures were designated as the lectotype of the species *Canrena neritoidea* Link, by Cernohorsky (1969).

The monotypic genus *Sistrum* Montfort, 1810, has been erroneously used by many authors for the species rightly contained in *Morula* Schumacher, 1817, which has *Drupa uva* Röding, as the type-species. *Sistrum album* Montfort, the type-species of *Sistrum* by original designation, is a synonym of *Drupa ricinus* (Linnaeus). In his discussion of *Sistrum album*, Montfort considered the species to have a white, violet or yellowish aperture, a misconception common with writers of the day. Although the violet aperture would indicate the species *Drupa morum*, Montfort's figure of *Sistrum album*, the specific name itself and its French, Dutch and Flemish equivalents of "Le Sistre blanc," "La mure blanche," "wite moerbesie" and "witte moerbeyer," all refer to the white-mouthed form of *Drupa ricinus* (Linnaeus).

Subgenus *Drupa sensu stricto*

Shell small to medium, strong, heavy, subovate; whorls low or conical, often with siphonous tubercles, 2 tubercles rarely extended from the margin as lobate processes; surface generally sculptured with imbricated scales; aperture noticeably constricted posteriorly by labial teeth; teeth arranged in compound groups; columella typically with 1 prominent axial fold, rarely with 2 folds, and with 3-5 prominent oblique plications; radular formula 1-1-1, lateral teeth fang-like, similar in shape, central tooth typically composed of a large medial cusp, flanked by a pair of slightly smaller, bifid to quadridifid cusps, and small, slender lateral denticles; operculum sub-lunar to sub-linear, nucleus marginal, marginal callus well developed, muscle scars few in number, arranged as gyroratory lines.

Members of this genus are typical coral and reef forms, being confined to the tropical

waters of the Indo-Pacific region, although some species occur at Easter, Clipperton and the Galápagos Islands, in the tropical eastern Pacific.

Drupa morum morum Röding, 1798

(Pl. 2, figs. 1-3; Pls. 10, 11)

Range—Red Sea and East Africa to the Eastern Pacific including Easter and Clipperton Islands (except the Marquesas Islands).

Remarks—The purple-colored aperture and the shorter tubercles distinguish this species from the white- or yellow-mouthed form of *D. ricinus*. The possession of tubercles, the deeper purple color of the aperture and the lack of dorsal bands offset this from the Marquesas subspecies *D. morum iodostoma* (Lesson, 1840).

Habitat—Intertidal on reef-flats, among rocks and in crevices; frequently found near the reef-edge on reefs exposed to strong surf.

Description—Shell 18 to 49 mm ($\frac{3}{4}$ to 2 inches) in length, ovately globose, spire acuminate, generally inconspicuous in adult stage. Whorls nodose with four rows of short, strong tubercles. Interstices between tubercles striated with scalelike striae. Aperture narrow, linear, extending nearly three-quarter the length of the shell. Outer lip crenulated between tubercles, dentate on the interior margin with plaitlike teeth; teeth arranged in an upper group of four denticles and in a lower group of three denticles. Two conspicuous plaits situated immediately above the deep canal. Inner lip enameled with a callus containing 3 or 4 plaitlike ridges projecting into the aperture above the canal. Posterior siphonal canal elongate, obliquely recurved toward the apex. Color white or grayish; tubercles dark-brown; interior of aperture deep purple in adults, light purple in immature specimens. Operculum typical of the group.

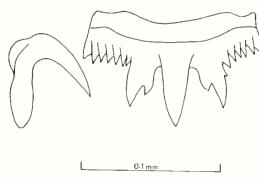


Plate 10. Radula of *Drupa (Drupa) morum morum* Röding.
Half a transverse row; Fiji Ids.

The central cusp of the rachidian of the radula is slightly longer than the flanking and bifid side-cusps; the side-cusps are followed by 3 to 5 small lateral denticles, exclusive of the slightly stronger end-cusps. In some specimens, the lateral denticles descend onto the side-cusps.

Measurements (mm)—(including spines; all specimens with a mature lip).

length	width	
49.1	45.9	S. E. Zanzibar
40.0	38.2	Lectotype of <i>horrida</i> Lamarck
32.4	29.6	Tosa, Japan
27.0	23.7	Viti Levu, Fiji
18.1	17.1	Bikini Atoll, Marshalls

Synonymy—

- 1684 — Buonanni, Rec. ment. oculi anim. test., (3), fig. 173 only (very poor).
 1685 — Lister, Hist. Syn. Meth. Conchyliorum, pl. 804, fig. 13.
 1753 — Klein, Tent. meth. ostr. nat. cochl., pl. 1, fig. 30.
 1758 *Nerita nodosa* Linnaeus (*pars*), Systema Naturae, ed. 10, p. 777 (refers to Lister, Klein and Buonanni, (fig. 173) only).
 1767 *Murex neritoidea* Linnaeus (*pars*), Systema Naturae, ed. 12, p. 1219 (refers to Lister, Klein and Buonanni (fig. 173) only); 1791 Gmelin (*pars*), Systema Naturae, ed. 13, p. 3537 (refers to Lister (fig. 13 only), Buonanni, Klein, Knorr and Martini (figs. 972, 973 only) and Seba (fig. 41 only); 1825 Wood, Index Testaceologicus, p. 123, pl. 26, fig. 47a.
 1768 — Knorr, Verg. Augen u. Gemüths, pt. 1, pl. 25, figs. 5, 6 (good).
 1777 "Murex Morum *globosum*" Martini, Syst. Conchylien-Cabinet, vol. 3, p. 280, pl. 101, figs. 972, 973 (East Indies and coast of Coromandel) [non binomial].
 1798 *Drupa morum* Röding, Museum Boltenianum, p. 55 refers to Martini and Knorr [no locality given]; 1913 Hedley, Nautilus, vol. 27, no. 7, p. 80; 1936 Hirase, Coll. Jap. shells, p. 79, pl. 110, fig. 8; 1957 Kaicher, Indo-Pacific Sea Shells, pl. 4, fig. 3; 1960 Hertlein, Veliger, vol. 3, no. 1, p. 8 (Galápagos and Clipperton Ids.); 1961 Ruppigade & McMichael, Queensland and Gt. Barrier reef shells, pl. 13, fig. 5; 1965 Arakawa, Venus: Jap. Journ. Malacology, vol. 24, no. 2, p. 114, pl. 13, figs. 3, 4 (radula); 1965 Wu, Bull. Inst. Zool. Acad. Sinica, vol. 4, p. 98, text fig. 19 (radula); 1967 Orr Maes, Proc. Acad. Nat. Sci. Philadelphia, vol. 119, no. 4, p. 129; 1969 Cernohorsky, Veliger, vol. 11, no. 4, p. 298, pl. 47, fig. 7 (shell), text fig. 4 (radula); 1970 Salvat, Cahiers du Pacific, no. 14, p. 46; 1971 Wilson & Gillett, Australian Shells, p. 92, pl. 61, fig. 2; 1971 Kay, Pacific Science, vol. 25, pp. 266, 275.
 1807 *Canrena neritoidea* Link, Beschr. Nat.-Sammel. Univ. Rostock, 3 Abth., p. 126 (refers to Martini, pl. 101, figs. 972, 973—designated as lectotype figures by Cernohorsky, 1969) [no locality given].
 1816 *Ricinula horrida* Lamarck, Tabl. Encycl. Methodique, p. 1, pl. 395, figs. 1a, b (no locality given); 1822 Lamarck, Hist. nat. anim. s. vertébrés, vol. 7, p. 231 (Indian Ocean); 1823 Sowerby, Genera Rec. foss. shells, pt. 18, pl. 18, fig. 1; 1842 Reeve, Conchologia Systematica, vol. 2, p. 215, pl. 156, fig. 1; 1846 Reeve, Conchologia Iconica, vol. 3, pl. 1, fig. 3; 1859 Chenu, Manuel Conchyliologie,

vol. 1, p. 168, fig. 814; 1880 Tryon, Manual Conchology, vol. 2, p. 184, pl. 56, figs. 201, 202; 1933 Dautzenberg & Bouge, Journal de Conchyliologie, vol. 77, p. 238.

1817 *Ricinella violacea* Schumacher, Essai Nouv. Système, p. 240 (refers to Martini, *op. cit.*) [no locality given].

1823 *Ricinula horrida* (sic) Children, Quart. Journ. Sci. Lit. & Arts, vol. 16, p. 56, pl. 5, fig. 189.

1832 *Purpura horrida* Lamarck, Blainville, Nouv. Ann. Mus. d'Hist. Nat. Paris, ser. 3, vol. 1, p. 208; 1833 Quoy & Gaimard, Voyage L'Astrolabe, vol. 2, p. 576, pl. 39, figs. 1-3 (animal and operculum); 1835 Kiener, Spéc. gén. icon. coq. viv., vol. 8, p. 8, pl. 1, fig. 1 (animal).

1850 *Sistrum horridum* M. Gray, Figs. Moll. Animals, vol. 4, p. 70, pl. 96, fig. 11; 1911 Schepman, Sioboga-Expedition, vol. 49d, p. 355; 1952 Morris, Field Guide shells Pacific coast and Hawaii, pl. 39, fig. 5.

1852 *Ricinula (Pentadactylus) globosa* Mart., Mörch, Cat. Conchyl. Yoldi, vol. 1, p. 88 (synonymized with *R. horrida* Lamarck and *Drupa morum* Röding).

1853 *Pentadactylus* (*Pentadactylus*) *globosus* H. & A. Adams, Genera Rec. Mollusca, vol. 1, pp. 129, 130, pl. 13, fig. 6 (animal).

1908 *Pentadactylus* (*Pentadactylus*) *horridus* Lamarck, Horst & Schepman, Cat. Syst. Moll. Mus. Hist. Nat. Pays-Bas, vol. 13, p. 157.

1938 *Drupa (Drupa) morum* Röding, Adam & Leloup, Mém. Mus. Roy. d'Hist. Nat. Belg., vol. 2, fasc. 19, p. 164.

Types—Since Röding's types are probably no longer extant, we designate the specimen depicted on plate 101, figs. 972, 973 in Martini, as the lectotype of *Drupa morum* Röding (pl. 11 fig. 1). Two syntypes of *Ricinula horrida* Lamarck, are in the Muséum d'Histoire Naturelle, Geneva; the specimen measuring 40.0 mm in length, no. 1101/12/1, is here selected as the lectotype of *R. horrida*. The type-specimen of *Ricinella violacea* Schumacher, could not be located in the University Zoological Museum, Copenhagen. From the two localities mentioned by Martini for *D. morum* s. s. we select the first-mentioned "East Indies" as the



1



2

Plate 11. *Drupa (Drupa) morum* Röding.
 Fig. 1. Lectotype figure from Martini, 1777, Syst. Conchylien-Cabinet, vol. 3, pl. 101, fig. 972.
 Fig. 2. Lectotype of *Ricinula horrida* Lamarck (MHNG no. 1101/12/1; 40.0 x 38.2 mm).

type locality, and restrict it further to Java, Indonesia (specimens in AMNH and ANSP).

Nomenclature—This species was well known to early naturalists but was confused by Linnaeus with *Thais nodosa* and *T. nodosa ascensionis* Quoy & Gaimard (= *meretricula* Röding). In his 12th edition of the "Systema Naturae," Linnaeus re-named the species *Murex neritoidea*, and cited the same erroneous figures which depict *Drupa morum*. However, in Linnaeus' personal copy of the 12th edition of the "Systema Naturae," the complete synonymy of the 10th edition description of *Nerita nodosa* has been cancelled and the following words were added: "Labium interius punitis 2 maculatum."

Records—RED SEA: Lahonel Beach, Gulf of Aqaba, Israel (Lamy, 1938, p. 56); Berenice, Egypt (ANSP); Mahmud reef, Jiddah, Saudi Arabia (AMNH). EAST AFRICA: SE Point, Isla de Serpenti, Chisimaito, Somalia (AMNH); Pangavini Id., 10 mi. NNE Dar-es-Salaam, Tanzania (MCZ); Diani Beach, Kenya (Heinicke, 1970, p. 7); Mozambique (USNM). ZANZIBAR: Chumbe Id.; Kiwengwa; Ras Nungwe (all ANSP). SEYCHELLES: (AMNH); Cousin Id. (ANSP). MADAGASCAR: S. side of Nosy Iranja, 32 mi. SW of Nossi Bé; Flacourt, Fort Dauphin; 2 mi. NE Point Anstrakiraihy (all MCZ). MAURITIUS: 1 mi. ESE of Souillac; Pointe Fayette (both ANSP); near Port Louis (MCZ); Pointe Pimentne, N. side Arsenal Bay (Powell coll.). REUNION ISLAND: (ANSP). CHAGOS ARCHIPELAGO: (Melville, 1909, p. 104). MALDIVE ISLANDS: Imma Id., SE North Male Atoll; Fadifolhu Atoll; Tiladhummati Atoll (all ANSP). LACCADIVE ISLANDS: (Hornell, 1922, p. 217). INDIA: Pamban and Shingle Id., Gulf of Manaar (Satyamurti, 1952, p. 160). CEYLON: 12 mi. N of Trincomalee (AMNH); Hikkaduwa (ANSP). THAILAND: Loam Seng, S. of Laam Son, Phuket Id. (ANSP). VIETNAM: Cam Ranh Bay (ANSP). COCOS-KEELING ISLANDS: N. end of Palo Siput; West Id., Cocos Id. (both ANSP). CHRISTMAS ISLAND: (Tomlin, 1935, p. 79). INDONESIA: Jesselton district, N. of Borneo; Pulau Boenta, off Aché Head, N. W. Sumatra; Sulau Bay, Batu group, off Sumatra; Mega, Mentawai Ids., S. W. Sumatra (all USNM); Queen's Bay,

off Sukabumi, Java (AMNH); Keledditan, Bantam, Java (ANSP); Batjan Id.; Manipa Id., W. of Halnahaera Id.; Mandidi Id.; Ambayana Id., all Moluccas (all MCZ). PHILIPPINES: Corregidor Id.; Manila Bay, Luzon Id.; Calapan, Mindoro Id.; Gigmoto, Catanduanes Id.; Cuyo Id.; Palawan group (all ANSP); Panay; Silino Id., Mindanao Id. (both USNM); Sanga Sanga Id., Sulu Archipelago (ANSP). FORMOSA (Taiwan): (AMNH); Suo; Karenko; Botan-wan; Ryukyu-Syo; Hoko (all Kuroda, 1941, p. 111). RYUKYU ISLANDS: Hyakuna reef (AMNH); Yomitan reef, Okinawa; Bolo Point, Kuzu-Saki, all Okinawa (all ANSP); NE coast of Iheya Shima (ANSP); Miyako (FMNH). JAPAN: Kikaiwa Shima, Osumi; Oshima Osumi (MCZ; USNM); Tosa (ANSP); Kii; Honshu (FMNH). MARIANAS: Maug; Agrihan (both USNM); Saipan; Tinian; Guam (all AMNH). PALAU ISLANDS: Babelthuap (ANSP); Koror; Eil Malk (both USNM). CAROLINE ISLANDS: Kayangel; Angulpehu; Gorokor; Ngargersiu (all ANSP); Yap (USNM); Ulithi; Itatlik; Elato; Satawal; Ponape; Kapingamarangi (all ANSP). MARSHALL ISLANDS: Eniwetok Atoll; Rongelap Atoll; Majuro Atoll; Ujae Atoll; Utirik Atoll (all USNM); Bikini Atoll; Arno Atoll (both AMNH). WAKE ISLAND: (AMNH; ANSP; MCZ). NEW GUINEA: Schouten Ids.; Wewak; Makira reef, Unca Id. (all ANSP); 2 mi N of Gusika, 13 mi. N. of Finschhafen (MCZ). AD-MIRALYA ISLANDS: Kormiau Id. (ANSP). AUSTRALIA: Queensland: Herald Cay, Coral Sea; Pipon reef near Cape Melville (both AMS); Wilson Id., Capricorn group (MCZ); Lady Elliot Id. (ANSP; AIM); Heron Id. (AIM); Tryon Id., Capricorn group (Powell coll.); Northern Territory: Darwin (FMNH); New South Wales: Middleton reef, off coast of New South Wales (Iredale, 1937, p. 256); Lord Howe Id. (AMS); West Australia: Barrow Id. (Wilson & Gillett, 1971, p. 92). NEW BRITAIN: Rabaul Harbour (ANSP). NEW IRELAND: Kavieng (AMNH). SOLOMON ISLANDS: NW Bougainville Id. (ANSP); Lutee, Choiseul Id.; Ataa, N. Malaita Id.; Lunga, Guadalcanal; Bellona Id. (all AMNH); Tikopia Id. (AIM); Bougainville; Bumana (both Powell coll.). NEW HEBRIDES: Tongoa, Espiritu Santo Id. (MCZ); Bushmen's Bay, E. Malekula Id. (AIM); Tanna Id. (DM). NEW CALEDONIA: Touho (AMNH); Isle of Pines (MCZ). LOYALTY ISLANDS: Lifu (USNM). FIJI ISLANDS: Savusavu, Vanua Levu (AMNH); Korolevu, S. Viti Levu (ANSP); Namana-i-Ra Id., N. Viti Levu (WOC coll.); Ongea Levu, Lau Ids. (USNM). GILBERT ISLANDS: Onotoa Atoll (MCZ); Kingsmill Id. (USNM); Nauru Id. (Hedley, 1903, p. 4). ELLICE ISLANDS: Funafuti (AMS; AIM). WALLIS ISLANDS: Nukuhifala (USNM). TONGA Islands: Hufagalupe, Tongatapu (ANSP); Ni-uato'ou Id. (USNM). SAMOA ISLANDS: Asau Harbour,

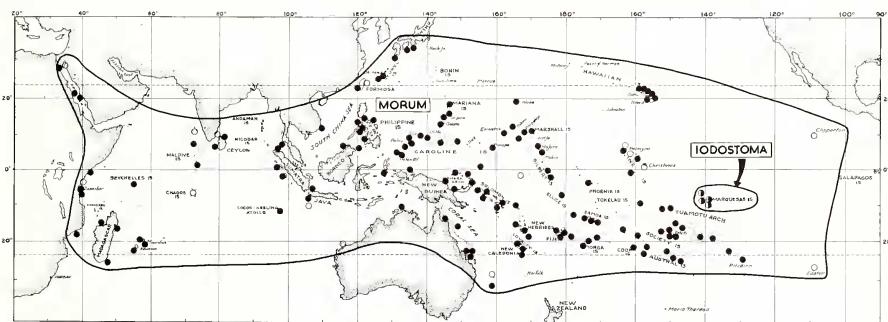


Plate 12. Geographical distribution of *Drupa (Drupa) morum morum* Röding, and its Marquesan subspecies *D. (D.)*

morum iodostoma (Lesson). Open circles are literature records.

Savaii; Pago Pago, Tutuila (both USNM); Apia, Upolu (AMNH; AIM). NIUE ISLAND: Alofi (USNM); Oneone reef; Namou reef (both AMNH). PHOENIX ISLANDS: Canton Id. (ANSP). COOK ISLANDS: Bird's Id.; North Id., both Palmerston Atoll (both USNM); Aitutaki; Mauke; Rarotonga; Mangaia (all USNM); Kopuano Passage, Aitutaki (AIM). PENRHYN ISLAND: (AMNH; AIM). AUSTRAL ISLANDS: Tubuai; Raivavae; Rurutu (all USNM). SOCIETY ISLANDS: many localities on Bora Bora; Huahine; Moorea; Tahiti (all USNM); Venus Point, Tahiti (AMNH). TUAMOTU ISLANDS: Tikaha Atoll; Vahitahi; Fakarava; Nengonengo; Makatea (all USNM). GAMBIER ISLANDS: Mangareva (USNM). LINE ISLANDS: Palmyra Id. (USNM); Fanning Id. (AMS); Caroline Id.; Flint Id. (both ANSP); Jarvis Id. (Powell coll.); Kingman reef; Washington Id.; Christmas Id. (all Kay, 1971, p. 275). HAWAIIAN ISLANDS: Kamilu; Kauai; Hanauana Bay, Oahu; Pukoo; Molokai; Honokowai reef; Maui; Hilo, Hawaii (all USNM); Kona, Hawaii (AMNH); Koko Head, Oahu; Waikiki, Honolulu (both Powell coll.). PITCAIRN ISLAND: (AMNH). EASTER ISLAND: (Steele, 1957, p. 112). CLIPPERTON ISLAND: (Hertlein & Allison, 1960, p. 15).

Fossil records—HAWAIIAN ISLANDS: Pleistocene: Oahu (Ostergaard, 1928, p. 6; Kosuge, 1969, p. 786, pl. 5, fig. 93).

Drupa morum iodostoma (Lesson, 1840)

(Pl. 2, figs. 4, 5; Pl. 13)

Range—Marquesas Islands.

Remarks—The lack of tubercles, the more quadrate shape, the dark dorsal bands and the pinkish violet aperture distinguish this uncommon subspecies from the nominate species *Drupa morum* Röding.

Early records from both literature and specimens are from numerous localities in the western Indo-Pacific, but reliable data indicate this taxon to be restricted to the Marquesas Islands. Records based on old collections in the National Museum of Natural History, Washington, and the Museum of Comparative Zoology, Harvard, can be confidently dismissed as being based on erroneous locality data, probably copies from locality indications given in old literature; these localities are "Malacca," "New Zealand," "Madagascar" and "Fiji Islands." However, there are several records of "*D. iodostoma*" from neighbouring areas to the Marquesas, such as Palmyra Island in the Line Islands (SDNHM), Venus Point, Tahiti (AMNH) and Fakarava Atoll, Tuamotus (ANSP); in addition, the subspecies has also been reported in literature from Marutea Island (Couturier, 1907) and Makatea Island (Boettger, 1918), both in the Tuamotu Archipelago. The literature records are suspected

misidentifications, while the actual specimens in the mentioned institutions have either been obtained through secondhand or have been documented by persons who also collected in the Marquesas Islands apart from the Tuamotus. Confirmed, recent collections suggest, therefore, that *D. iodostoma* is an allopatric subspecies of *D. morum*, and is endemic to the Marquesas Islands where *D. morum* is not known to occur.

Habitat—In surge channels cut into exposed volcanic shores (G. D. Stout, personal communication), and in rocky crevices at a depth of 10 feet.

Description—Shell 32 to 47 mm (about 1½ to 2 inches) in length, quadrately globose, spire very short and acuminate. Whorls faintly axially plicate, spirally ribbed by five wide, slightly raised ribs which are more pronounced toward the margin. Interstices between ribs striated with 3 lirations. Aperture narrow, linear, extending nearly three-quarter the length of the shell. Outer lip crenulated between ribs, inner margin dentate; teeth compound, 3 to 4 denticles in the upper tooth, 2 to 3 denticles in the lower tooth. Above the anterior canal are two conspicuous plaits. Columella with three to four heavy plications projecting into the aperture. Posterior siphonal canal elongate, obliquely curved toward the apex. Color cream, spiral ribs brownish black, intersticial spiral threads reddish brown; aperture pinky-violet.

The radula is similar to *Drupa morum*; the rachidian has bifid side-cusps and 4 or 5 lateral denticles. The radula of "*Drupa iodostoma*" as figured by Cooke (1919) from the "Sandwich Islands" [= Hawaiian Ids.], is probably based on Hawaiian specimens of *D. morum*.

Measurements (mm)—(all specimens with a mature lip).

length	width
47.0	43.0
38.0	36.5
36.0	32.7
30.3	27.0

Nukuhiva, Marquesas Ids.
Nukuhiva, Marquesas Ids.
Tahuata, Marquesas Ids.
Tahuata, Marquesas Ids.

Synonymy—

- 1840 *Purpura (Ricinula) iodostoma* Lesson, Rev. Zool. Soc. Cuvierienne, vol. 3, p. 355 ("New Zealand" = error!).
1842 *Purpura iodostoma* Lesson, Géfrin's Magasin de Zoologie, vol. 4, p. 58, pl. 58.



Plate 13. Radula of *Drupa (Drupa) morum iodostoma* (Lesson). Half a transverse row; Tahuata, Marquesas Ids.

1846 *Ricinula iodostoma* Lesson, Reeve, Conchologia Iconica, vol. 3, pl. 1, figs. 4a, b; 1860 Reeve, Elements of Conchology, vol. 1, p. 82, pl. 7, fig. 32; 1880 Tryon, Manual of Conchology, vol. 2, p. 184, pl. 56, fig. 199.

1888 *Ricinula iodostoma* (sic) Lesson, Paetel, Catalog der Conchyl-Sammlung, vol. 1, p. 143 (New Zealand [erroneous]).

1908 *Pentadactylus (Pentadactylus) iodostomus* Lesson, Horst & Schepman, Cat. Syst. Moll. Mus. Hist. Nat. Pays-Bas, vol. 13, p. 154.

1913 *Drupa iodostoma* Lesson, Hedley, The Nautilus, vol. 27, no. 7, p. 80; 1957 Kaicher, Indo-Pacific Sea Shells, pl. 4, fig. 5 (Malaysia and Melanesia [= error!]); 1965 Hertlein, Occ. Papers California Academy of Sciences, no. 49, p. 2, figs. 1, 2 (Marquesas Islands).

1918 *Ricinula iodostoma* (sic) Lesson, Boettger, Abb. Senckenb. Naturfr. Gesellschaft, vol. 36, (3), p. 298. [Probably misidentified *Drupa morum* Röding].

Types—The type-specimen of *Drupa iodostoma* (Lesson) is probably in the Muséum National d'Histoire Naturelle, Paris. The given locality "New Zealand" is erroneous, as the species does not live there. Since the type-specimen was collected during the voyage of the "Vénus," which visited the Marquesas

after the 14th of August, 1838, and also called at the Bay of Islands, New Zealand, during October 1838 (Chamberlin, 1960, p. 67), the erroneous locality is obviously due to a mix-up of specimens during the voyage. Since reliable records are known only from the Marquesas, we designate Taiohae, Nukuhiwa Island, Marquesas Islands, as the type locality of *D. morum iodostoma*.

Records—MARQUESAS ISLANDS: Hana Nui and Haavie Bays, Ua Huka Id.; Eiao Id. (all ANSP); Taiohae, Nukuhiwa Id. (USNM; AMNH); N. side Hana Moe Noe Bay, Tahuata (USNM).

Drupa ricinus ricinus (Linnaeus*, 1758)

(Pl. 2, figs. 6-8, 11; Pls. 14, 15, 16)

Range—From East and South Africa to the Eastern Pacific, at Easter, Clipperton and Galapagos Islands.

Remarks—Differs from *D. morum*, which has a proportionally larger shell, in having longer spines, a smaller size and in lacking the purple or mauve apertural coloration. *D. elegans* (Broderip & Sowerby) differs mainly by possessing a continuous, red-brown line encircling the aperture; it is restricted to Polynesia where it is found with the present species.

*It is the editorial policy to allow authors to use their own preference in spelling this name. Linnaeus or Linne.

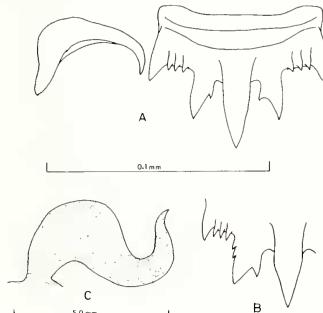


Plate 14. *Drupa (Drupa) ricinus ricinus* (Linnaeus)—white mouthed form; Fiji Islands.

Fig. A. Radula; half a transverse row.

Fig. B. Part of rachidian of radula showing variation in the number of accessory denticles on the side-cusps.

Fig. C. Penis.

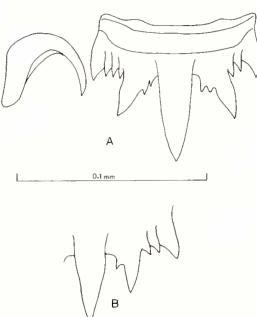


Plate 15. *Drupa (Drupa) ricinus ricinus* (Linnaeus)—yellow mouthed form; Fiji Islands.

Fig. A. Radula; half a transverse row.

Fig. B. Part of rachidian of radula showing variation in the side-cusps and lateral denticles.

Commonly, *D. ricinus* may have a faint orange or yellow, diffused line encircling the aperture.

Populations with large shells, attaining nearly 40 mm in length, are present in the Red Sea. This form appears to be geographically isolated from the smaller-shelled, nominate subspecies, and it is recognized herein as a new subspecies *Drupa ricinus hadari*.

Habitat—Lives exposed, or in water up to approximately 10 feet deep, on or under rocks, sand, weed or coral, on exposed wave benches or fringing reefs. At Clipperton Island the species has been collected to a depth of 22 fathoms.

Description—Shell 17 to 35 mm (about $\frac{3}{4}$ to $1\frac{1}{2}$ inches) in length, solid, obovoid, spire short, reduced, obscure in adult specimens, body whorl three-quarter the length of the shell. Whorls ribbed with five rows of sharp spines; spines variable in development, but higher near the margin of the aperture. Intercostae between spines striated with scale-like striae. Aperture linear, constricted by the teeth and callus. Apertural dentition as in *D. morum* with features less prominent. Color white or grayish; spines dark-brown to dark-gray, especially toward the tips; mouth white or with a wide, broken, diffused, orange to yellow line extending around the outer lip and neighbouring canal area. Operculum typical for the group.

In the radula, the side-cusps of the rachidian are short or moderately long, bifid to quadrifid, and are followed by 2-3 side-denticles, exclusive of the end-cusps.

Measurements (mm)—(including spines; all specimens with a mature lip).

length	width	
32.3	27.8	Kagoshima, Japan
29.5	25.5	Lectotype of <i>arachnoides</i> Lamarck
25.6	27.0	S. Viti Levu, Fiji Ids.
23.0	25.0	Probable holotype of <i>ricinus</i> Linnaeus
22.8	21.0	Penrhyn Id.
17.2	16.3	Samarai, Papua

Synonymy—

- 1705 — Rumphius, Amboinsche Rariteitkammer, pl. 24, fig. E.
 1742 — d'Argenville, L'Histoire Naturelle , pl. 17, fig. A.
 1742 — Gualtieri, Ind. test. Conchyliorum, pl. 28, fig. N (poor).

- 1758 *Murex ricinus* Linnaeus, Systema Naturae, ed. 10, p. 750 (refers to Rumphius and Gualtieri, *op. cit.*) [Asiatic Ocean] (yellow and white forms).
 1758 *Murex hystrix* Linnaeus, Systema Naturae, ed. 10, p. 750 (refers to d'Argenville, *op. cit.*) [no locality given] (juvenile specimen); 1855 Hanley, Ipsa Linn. Conch., p. 294.
 1777 "Murex Morum globosum" Martini, Syst. Conchylien-Cabinet, vol. 3, p. 280, pl. 102, figs. 976, 977 (non binomial) [yellow form].
 1798 *Drupa tribulus* Röding, Museum Boltenianum, p. 55 (refers to Rumphius and Gualtieri, *op. cit.*) [no locality given].
 1798 *Drupa rubuscaerulea* Röding, *ibid.*, p. 55 (refers to Martini, *op. cit.*) [no locality given] (yellow form).
 1810 *Sistrum album* Montfort, Conchyliologie Systématique, vol. 2, p. 595, fig. on p. 594 (white form) [no locality given].
 1816 *Ricinula arachnoides* Lamarck, Tableau Encyclopédique Méthodique, p. 1, pl. 395, figs. 3a, b (no locality given) [yellow form]; 1822 Lamarck, Hist. nat. anim. s. verbes, vol. 7, p. 232 (Indian Ocean); 1823 Sowerby, Gen. Rec. fossil shells, pt. 18, pl. 235, fig. 5 (juvenile specimen); 1842 Reeve, Conchologia Systematica, vol. 2, p. 215, pl. 256, fig. 5 (juvenile specimen); 1846 Reeve, Conchologia Ionica, vol. 3, pl. 1, fig. 5; 1859 Chemu, Manuel de Conchyliologie, vol. 1, p. 168, fig. 812.
 1831 *Murex neritoideus* Mawe, Wodarch's Intr. Conchology, pl. 3, fig. 43 (yellow form) [non Linnaeus, 1767].
 1832 *Purpura albo-labiata* Blainville, Nouv. Ann. d'Hist. Nat. Paris, ser. 3, vol. 1, p. 208, pl. 9, fig. 5 (Trincomalee, Ceylon) [white form]; 1835 Kiener, Spéc. gén. icon. coq. viv., vol. 8, p. 12, pl. 1, fig. 2.
 1832 *Purpura arachnoides* Blainville, *ibid.*, p. 209 (yellow form); 1833 Quoy & Gaimard, Voyage L'Astrolabe, vol. 2, p. 579, pl. 39, figs. 17-19 (animal and operculum); 1835 Kiener, Spéc. gén. icon. coq. viv., vol. 8, p. 10, pl. 1, figs. 3, 3a; 1848 Krauss, Südafrik. Moluskens, p. 115 (Natal).
 1850 *Sistrum arachnoides* Lamarck, M. Gray, Figs. Moll. Animals, vol. 4, p. 70, pl. 96, fig. 2.
 1853 *Pentadactylus ricinus* Linnaeus, H. & A. Adams, Gen. Rec. Mollusca, vol. 1, p. 130; 1875 Troschel, Gebiss der Schnecken, vol. 2, p. 134, pl. 13, fig. 5 (radula).
 1859 *Ricinula albolabris* Blainville, Chemu, Manuel de Conchyliologie, vol. 1, p. 168, fig. 812.
 1880 *Ricinula ricinus* Linnaeus, Tryon, Manual Conchology, vol. 2, p. 184, pl. 56, fig. 200 and pl. 57, figs. 204, 206, 212; 1933 Dautzenberg & Bouge, Journal de Conchyliologie, vol. 77, p. 240.
 1884 *Pentadactylus arachnoides* Lamarck, Fischer, Manuel de Conchyliologie, fasc. 7, p. 646, pl. 6, fig. 9.
 1911 *Sistrum ricinus* Linne', Schepman, Siboga-Expedition, vol. 49d, p. 354.
 1913 *Drupa ricinus* Linne', Nautilus, vol. 27, no. 7, p. 80; 1937 Hertlein, Proc. Amer. Phil. Society, vol. 78, no. 2, p. 308, pl. 1, figs. 5, 6 (Clipperton and Galapagos Ids.); 1967 Orr Maes, Proc. Acad. Nat. Sci. Philadelphia, vol. 119, no. 4, p. 129; 1969 Cernohorsky, Veliger, vol. 11, no. 4, p. 299, pl. 47, figs. 8, 8a (shell), text figs. 5, 6 (radula); 1970 Salvat, Cahiers du Pacifique, no. 14, p. 46; 1971 Kay, Pacific Science, vol. 25, pp. 266, 275; 1971 Wilson & Gillett, Australian Shells, p. 92, pl. 61, figs. 3, 3a.
 1915 *Drupa rubus-caerulea* Dall, Smithsonian Inst. Publ. no. 2360, p. 29 (refers to Röding, 1798, p. 55, species 695 = *D. tribulus* Röding).
 1929 *Drupa (Drupa) ricinus* Linnaeus, Thiele, Handb. syst. Weichtierkunde, vol. 1, p. 295; 1938 Adam &

- Leloup, Mém. Mus. Roy. d'Hist. Nat. Belg., vol. 2, fasc. 19, p. 164.
- 1933 *Ricinula ricinus* var. *arachnoides* Lamarck, Dautzenberg & Bouge, Journal de Conchyliologie, vol. 77, p. 240.
- 1960 *Drupa ricina* Linnaeus, Hertlein, Veliger, vol. 3, no. 1, p. 8; 1965 Arakawa, Venus: Jap. Journ. Malacology, vol. 24, no. 2, p. 115, pl. 13, fig. 1 (radula); 1965 Wu, Bull. Inst. Zool. Acad. Sinica, vol. 4, p. 98, text fig. 18 (radula); 1965 Wu, Malacologia, vol. 3, no. 2, p. 211, text figs. (anatomy).
- 1960 *Drupa ricina* forma *albolabris* Blainville, Hertlein, Veliger, vol. 3, no. 1, p. 8.
- 1965 *Drupa albolabris* (Blainville), Arakawa, Venus: Jap. Journ. Malacology, vol. 24, no. 2, p. 114, pl. 13, fig. 2 (radula).
- 1965 *Drupa arachnoides* Lamarck, Wu, Bull. Inst. Zool. Acad. Sinica, vol. 4, p. 98, text fig. 18 (radula).

Types—The probable type-specimen of *Drupa ricinus* (Linnaeus) [Pl. 16, fig. 2], is in the Linnean collection of the Linnean Society, London. This particular specimen is the yellow-spotted form, which has a no. 540 written on the columella (the number of *Murex ricinus* in the 12th edition of the "Systema Naturae"). Two additional, undocumented specimens are also in the collection, an adult of the white form and a juvenile specimen. Five syntypes of *Ricinula arachnoides* Lamarck, are in the Muséum d'Histoire Naturelle, Geneva, and the 29.5mm long syntype, no. 1101/15/4, is here selected as the lectotype (Pl. 16 fig. 4). The type-specimen of *Purpura albolabris* Blainville, is probably in the Muséum National d'Histoire Naturelle, Paris. The type locality of *D. ricinus* is "Asiatic Ocean," which is here restricted to Ceylon (specimens in MCZ, ANSP and AMNH).

Nomenclature—Much confusion has existed regarding the identity of this taxon. Lamarck, 1822, considered *Murex hystrix* Linnaeus, to be the pink-apertured species which is correctly known as *Drupa rubusidaeus* Röding. This misconception was continued by many early authors. Actually, as is pointed out by Hanley (1855), Linnaeus referred Regenfuss' (1758) excellent colored figure of *Drupa rubusidaeus* Röding to *Murex hippocastanum* in his 12th edition of the "Systema Naturae," and not to *Murex hystrix*. In the 10th edition, the short diagnosis of *Murex hystrix* was accompanied by only one figure reference, pl. 17, fig. A of d'Argenville, 1742. This engraving (see Pl. 16 fig. 1) unmistakeably represents the dorsal aspect of *Drupa ricinus* as indicated by the long, obliquely slanted spines which characterize some forms of this species. In the description Linnaeus states: "apertura edentula repanda,"

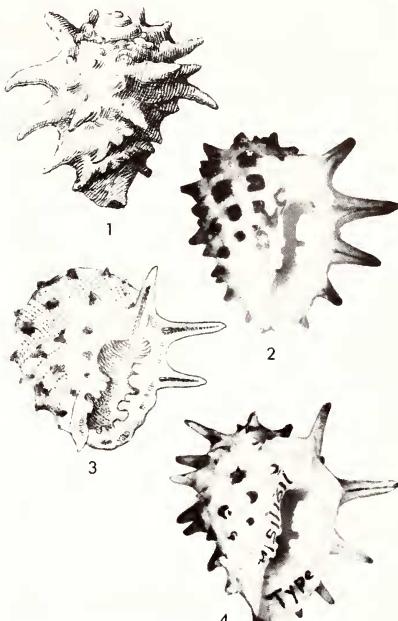


Plate 16. *Drupa (Drupa) ricinus ricinus* (Linnaeus).

Fig. 1. Lectotype figure of *Murex hystrix* Linnaeus, from d'Argenville, 1742, L'Histoire Naturelle ... Conchyliologie, pl. 17, fig. A.

Fig. 2. Probable type-specimen of *Murex ricinus* Linnaeus, from the "Asiatic Ocean" (Linnean Society of London coll.; 23.0 x 25.0 mm).

Fig. 3. Lectotype figure of *Drupa rubusidaeus* Röding, from Martini, 1777, Syst. Conchylien-Cabinet, vol. 3, pl. 102, fig. 97.

Fig. 4. Lectotype of *Ricinula arachnoides* Lamarck (MHNG no. 1101/15/4; 25.5 x 29.5 mm).

an indication that this species was based on specimens in which the dentate lip has not yet developed. Thus it can be safely assumed that *Murex hystrix* Linnaeus, is nothing more than a juvenile of *Drupa ricinus* Linnaeus.

At the present time, some students recognize two species, the form with a white aperture as *Drupa albolabris* (Blainville) and the yellow-orange spotted form as *D. arachnoides* (Lamarck). The latter should not be confused with the yellow-mouthed *D. grossularia* Röding. In a detailed sampling of *D. ricinus* in the Fiji Islands by the junior author (Cernohorsky, 1969), both

forms were found not only to be sympatric in various localities, but were sharing the same rock in many instances. No sexual dimorphism was observed in either color form, and no differences in either living animal, radula, color of the stomach pouch or the penis were apparent in either form. The number of accessory side-denticles in the rachidian of the radula varied from 3 to 5 in both color forms. Both color forms of *D. ricinus* have been collected together at various other Indo-Pacific localities. Hertlein and Allison (1960) recorded the presence of both color forms of *D. ricinus* at Clipperton Island, an isolated coral atoll in the eastern Pacific, located about 670 miles southwest of Acapulco, Mexico. The white-apertured form was reported to be living among boulders and coral debris on the outer parts of the reef flats, and off the edge of the reef flats, in coral and coral rubble, to a depth of at least 130 feet, the lower limit of collecting by their SCUBA divers. Although the white-apertured form was found in abundance, only abraded specimens of the yellow-orange form were on the beach and off shore at a depth of 70 feet. In the New Hebrides the white-mouthed form only was found by the junior author.

Records—(inserted in brackets; y = yellow-spotted form, w = white form). GULF OF ADEN: Aden (Shopland, 1896, p. 220). EAST AFRICA: Isla di Serpenti, Chisimao, Somalia (AMNH; yw); Port Amella, Mozambique (AMNH; y); Kendwa Id., 4 mi. ESE Dar-es-Salaam, Tanzania; Pangavini Id., 10 mi. NNE Dar-es-Salaam, Tanzania; Ras Kankalya, 6 mi. N. Dar-es-Salaam, Tanzania (all MCZ; y); Diani Beach, Kenya (AMNH; USNM; y); Mombasa, Kenya (AMNH; y). ZANZIBAR: (AMNH; w); Ras Nyngwe; Chumbe Id.; Jembaani, 5 mi. S. Paje; Kiwenga (all ANSP; y). SOUTH AFRICA: Umtwalumi, 22 mi. N. Port Shepstone, Natal; East London (both ANSP; y). SEYCHELLES: Loraie Bay, Curiere Id.; Anse aux Pins (both ANSP; y); Coetivy Id.; Praslin Id. (Mell-

vill, 1909, p. 103). MADAGASCAR: Ambodifotra, Isle St. Marie (MCZ; w); N. E. of Pointe Antsirakirai, NW Isle St. Marie; Ambanibobe, S.E. Nossi Bé; Grande Recife, Tulear; Pointe Ibanoba, Fort Dauphin (all MCZ; y). REUNION: (ANSP; w). MAURITIUS: Pointe Fayette, S.W. Port Louis (both ANSP; w); 1 mi. NW Black River (ANSP; y). MALDIVES ISLANDS: Ongu Id., N. Malosmadulu Atoll; Wala Id., Nilandu Atoll; Fadifolu Atoll (all ANSP; y); Imma Id., N. Male Atoll (ANSP; w). CEYLON: (MCZ; w); Pointe de Gallett (ANSP; y); 12 mi. N. of Trincomalee (AMNH; y). ANDAMAN ISLANDS: (Mevill & Sykes, 1899, p. 222) THAILAND: Laam Seng, 1 mi. S. Laam Son, Phuket Id. (ANSP; y); Goh Huyong, Similan Ids. (USNM; y). VIETNAM: Con Son Ids. (Fischer, 1891, p. 149). COCOS-KEELING ISLANDS: Direction Id. (ANSP; y); E. side of Horsburgh Id.; SW side West Id. (both ANSP; y). CHRISTMAS ISLAND: (Tomlin, 1934, p. 79). INDONESIA: Pulau Bai, Batu group, off Sumatra; Pulau Stupai, Mentawai Ids., S.W. Sumatra; Pelaboean Rateo, Preanger, Java (all USNM; y); Morotai Id., Moluccas (MCZ; y); Mantanani Id. and Mandi Darrah Id., N. Borneo (both ANSP; y); Batu Dua and Palau Pombo, Wasi, Ambon I. (both FMNH; y); Malawali, N. Borneo (AMNH; y). PHILIPPINES: Many localities throughout the Archipelago; Luzon Id.; Mindoro Id.; Cebu Id.; Sulu Archipelago (AMNH; ANSP; y); Samar Id.; Catanduanes Id.; Palawan Id. (AMNH; ANSP; yw); Calamianes group; Mindanao Id. (AMNH; ANSP; MCZ; w); Borongan village, Samar Id.; Gigmoto, Catanduanes Id. (both AM; yw). FORMOSA (Taiwan): Tainan beach (AMNH; w); Suo, Kasyo-to; Botanwan; Ryukyu-syo; Hoku (Kuroda, 1941, p. 111; y); Karenko; Lasyo; Garabi; Hoku; Ryukyu-syo (Kuroda, 1941, p. 111; w). RYUKYU ISLANDS: Kikaiwa Shima (ANSP; y); Bolo reef, NW Nakagami Gun, Okinawa (USNM; y); Okuma, Kuni-gami-Gun; Odomari, Okinawa (both USNM; y); Yomitan reef, Okinawa (AMNH; yw). JAPAN: Oshima, Osumi (USNM; yw); Hachijo Id., off Honshu (ANSP; w); Tosa, Shikoku (ANSP; y); Kagoshima, Kyushu (ANSP; w). MARINAS: Lagunan Tanapaa, Saipan; Agat Bay, Guam (both ANSP; y); Apra Harbour, Guam (AMNH; y); Tinian Id. (FMNH; yw); several localities on Guam Id. (USNM; w); Saipan (AMNH; w). PALAU ISLANDS: Angpeln Id., SE Koror Id.; reef N. of Gorokottan Id., S. side W. Passage, Babelthuap Id. (both ANSP; y); S. E. of Auropushekuru Id., Malakal Harbour, Koror Id. (ANSP; yw); Angaur, Pelelin Id. (FMNH; w). CAROLINE ISLANDS: N. of Kayangel Id.; S. of Garakayo Id.; Ponape; Yap (all ANSP; y); Ulithi Atoll; Satawal Atoll; Manini, Kapingamarangi (all USNM; y); S.E. Rattakadokoru Id. (ANSP; w). MARSHALL ISLANDS: Eniwetok Atoll; Kwajalein Atoll (both AMNH; y); Bikini Atoll; Eniwetok Atoll; Rongelap Atoll; Rongerik Atoll; Kwajalein

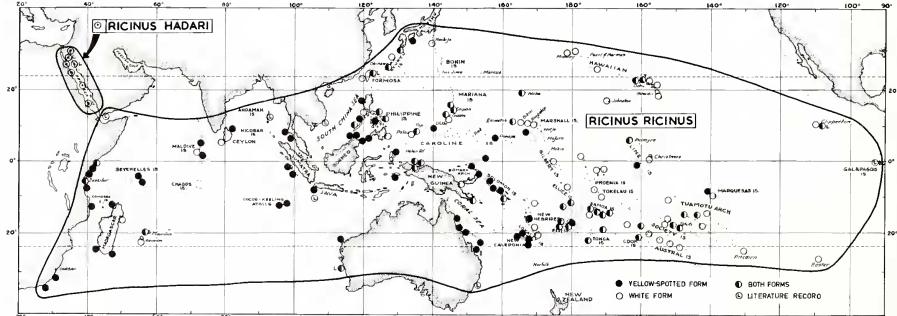


Plate 17. Geographical distribution of *Drupa* (*Drupa*) *ricinus* (*Linnaeus*) in the Indo-Pacific, and its subspecies

D. (D.) ricinus hadari Emerson and Cernohorsky, in the Red Sea.

Atoll (all ANSP; w). WAKE ISLAND: (AMNH; yw; ANSP; y). NEW GUINEA: NE Noeori Id.; Manokwari SW Biak dock, Biak Id. (all ANSP; y); Boensaki Id., off Sowek, Seopiori Id., Schouten Ids. (ANSP; yw); NE Mfies Woendi, Padaido Ids. (ANSP; yw); Samarai, Papua (AMNH; yw); Huon Gulf (USNM; w). AUSTRALIA: Queensland: Capricorn Ids.; Hardy reef, Great Barrier reef (both AMNH; y); Birds Id.; Green Id., Cairns (both USNM; y); Magnetic Id.; Lady Elliot Id. (both AIM; y); New South Wales: (Iredale & McMichael, 1962, p. 74); West Australia: Vlaming Head (FMNH; y); Houtman, Abrolhos Archipelago (Wilson & Gillett, 1971, p. 92). NEW BRITAIN: Rabaul Harbour (ANSP; y). NEW IRELAND: Kavieng (AMNH; y). SOLOMON ISLANDS: Kieta, Bougainville; Lutec; Choiseul Id.; Ataa, N. Malaita Id.; Tulaga Id.; Santa Ana Id. (all AMNH; y); Tikopia Id. (AIM; w); Lunga, Guadacelase Id. (AMNH; y). NEW HEBRIDES: Lamap, Malekula Id. (ANSP; w); Bushmens Bay, E. Malekula Id. (AM; w); Pango Point, Efate Id. (AIM; w); Tauna Id. (DM; w). NEW CALEDONIA: SE Dumbaa Pass, off Noumea, Baie Oquem, Noumea, Koe, Touho (all ANSP; y). LOYALTY ISLANDS: Lifu (USNM; y). GILBERT ISLANDS: Abemama (USNM; w). ELICE ISLANDS: Funafuti lagoon (USNM; AIM; w). WALLIS & FUTUNA ISLANDS: Faioa; Uvea; Nukuhifala, all Wallis Id. (USNM; y); Nukuhifala, Wallis Id. (USNM; w); Anse de Sigave, Futuna Id. (USNM; yw); Mua, Alofi, Hoorn Id. (USNM; y). FIJI ISLANDS: Koro Bay reef, Vanua Levu (AMNH; y); Suva Harbour, S. Viti Levu (USNM; y); Korolevu, S. Viti Levu; Yasawa reef (both AMNH; w); Namagamagua village, S. Viti Levu (WOC coll.; w); Raat Tail Passage, Suva reef, S. Viti Levu; Mamanuca group; Caboni beach; Manava Id.; Nanamu-iRa Id.; Viti Levu Bay, all Viti Levu (all WOC coll.; yw). TONGA ISLANDS: Ha'ateihia reef, Tongatapu; E. coast Tongatapu Id. (both USNM; y); Haakoma, Tongatapu (MCZ; w); Hufagalupe, Tongatapu (MCZ; yw); Niuafo on Id. (USNM; w). NIUE ISLAND: near Malatu (USNM; y); Oneone reef (AMNH; yw); Alofi (USNM; yw). SAMOA ISLANDS: Vailele Bay, Upolu, Tafuna, Tutuila (both ANSP; y); Fagaitua Bay, Tutuila, Ofu (both MCZ; w); Asau Harbor, Savaii (USNM; yw); Apia, Upolu (AMNH; yw); Tau Id., Manua group (MCZ; yw). TOKELAU ISLANDS: W. side Tukuo, Manihiki Atoll (ANSP; w); Swains Id. (USNM; w). PHOENIX ISLANDS: Canton Id.; Enderbury Id. (both USNM; w). HOWLAND ISLAND: (USNM; w). COOK ISLANDS: Bird's Id., Tom's Id.; North Id., all Palmerston Atoll (all USNM; w); Koromiri Id., SE Rarotonga (ANSP; y); several localities on Aitutaki; Mauke; Rarotonga; Mangaia (all MCZ; USNM; w); Motu Akaami, Aitutaki (USNM; yw). AUSTRALIAN ISLANDS: Rurutu; Tubuai; Raivavae (all USNM; w). SOCIETY ISLANDS: Mopelia Id. (ANSP; y); many localities on Bora Bora; Huahine; Raiatea; Moorea; Tahiti (USNM; w); Aue, Tahiti; Taope, Tahiti; Huahine (all USNM; yw). TUAMOTU ISLANDS: Napuka (AMNH; w); Tacume; Clermont Teneré; Takaroa (all ANSP; w); Rangiroa (AMNH; yw); Mangareva (USNM; w); Rarotonga (ANSP; yw). PITCAIRN ISLAND: (AMNH; USNM; w). MARQUESAS ISLANDS: Taihaoe, Nukuhiva (AMNH; y); Hiva Oa Id. (ANSP; w); ua Huka Id. (AMNH; ANSP; w). LINE ISLANDS: Christmas Id.; Flint Id.; Palmyra Id. (all ANSP; w); Palmyra Id. (MCZ; y); Jarvis Id. (AMNH; y). JOHNSTON ISLAND: (USNM; w). HAWAIIAN ISLANDS: Honolulu Harbour (ANSP; y); Kure Id.; Midway Id.; Layson Id.; Tern Id.; French Frigate Shoal; Kauai Id.; Oahu Id.; Molokai Id.; Maui Id.; Hawaii Id. (all AMNH; ANSP; USNM; w); Niihau Id.; Oahu Id. (both AIM; w); Lihue, Kauai (AMNH; yw). CLIPPERTON ISLAND: (AMNH; ANSP; w); (Hertlein & Allison, 1960, p. 15; yw). GALAPAGOS ISLANDS: (Hertlein, 1960, p. 8).

Fossil records. ZANZIBAR: Pleistocene: Base of well, village W. of Makunduchi (Cox, 1927, p. 90, pl. 18, figs. 12a, b and Stockley, 1928, p. 79). MOZAMBIQUE: Pleistocene: Chidenguel, Inhabanane district (Cox, 1939, p. 90). HAWAIIAN ISLANDS: Pleistocene: Oahu (Mansfield in Stearns and Vaksvik, 1935, p. 167; Kosuge, 1969, p. 786, pl. 5, fig. 90).

**Drupa ricinus new subspecies
hadari Emerson and Cernohorsky**

(Pl. 2, figs. 9, 10; Pl. 18)

Range—Red Sea only.

Remarks—Distinguished from the nominate subspecies *Drupa ricinus* (Linnaeus) by its larger size, heavier shell and more strongly developed parietal shield.

Habitat—Coral reefs and rocks, on intertidal reef-flats.

Description—Juveniles typical of those of both apertural color forms of the nominate subspecies, with spinose nodules dark brown. Nodules on the body whorl or mature specimens white, with brown nodules on spire only, or body whorl axially streaked with brown except on the last two or three rows of spines. Aperture in mature specimens white with fully developed parietal shield completely concealing nodular coloration of the parietal area.

The side-cusps of the rachidian of the radula are bifid and are followed by 2 weak, short lateral denticles, excluding the slightly longer end-cusps.

Measurements (mm)—(including spines)

length	width	
38.0	34.2	Eilat, Gulf of Aqaba (paratype AMNH no. 112617b)
37.2	38.7	Eilat, Gulf of Aqaba (holotype AMNH no. 166928)
34.2	34.1	Eilat, Gulf of Aqaba (paratype AMNH no. 112617a)
32.0	32.0	Eilat, Gulf of Aqaba (paratype AMNH no. 112617c)
28.0	29.0	Eilat, Gulf of Aqaba (paratype DMNH no. 51119)

Synonymy—

1862 *Ricinula albolarbris* Blainville, Küster (pars), Syst. Conchylien-Cabinet, ed. 2, Abt. 1E, *Ricinula*, pl. 2, figs. 1, 2 (Red Sea) [non *Purpura albolarbris* Blainville, 1832].

1941 *Drupa (Drupa) ricinus* (Linnaé), Wenz, Handb. Paläo-
zoologie, vol. 6, pt. 5, p. 1114, fig. 3165 (Red Sea)
[non *Murex ricinus* Linnaeus, 1758].

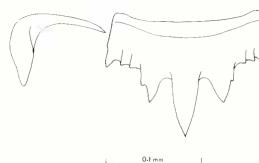


Plate 18. Radula of *Drupa (Drupa) ricinus hadari* Emerson and Cernohorsky. Half a transverse row; Eilat, Gulf of Aqaba, Israel.

Types—The holotype, AMNH No. 166928, and 8 paratypes AMNH No. 112617, have been deposited in the American Museum of Natural History, New York. Other paratypes are in the Delaware Museum of Natural History, Greenville, The Auckland Institute and Museum and the Tel Aviv University, Israel. The type locality is Eilat, Gulf of Aqaba, Israel.

Nomenclature—The subspecies is named in honor of the late Aryeh Hadar, who kindly submitted specimens from the Gulf of Aqaba for study.

Records—RED SEA: Sharem, Gulf of Suez (DMNH); Eilat, Gulf of Aqaba (AMNH; DMNH; AIN; w); Ras Banas, Egypt (USNM; w); Quseir, Egypt (LACMNH; y); Mualla, Abu Zabad, Gulf of Aqaba (Rees and Stuckley, 1952, p. 196); Suakin, Sudan (Sturany, 1905, p. 141); Jiddah, Saudi Arabia (AMNH; yw); Pointe du Requin, Ile Abulat (Franc, 1956, p. 37).

Drupa elegans (Broderip and Sowerby, 1829)

(Pl. 2, fig. 12; Pl. 19, 20)

Range—From Wake Island to the Tuamotu Islands.

Remarks—This species is similar to *Drupa ricinus* (Linnaeus), but differs in apertural coloration, the lack of tubercle coloring and in being smaller in size. This uncommon species occurs sympatrically throughout its range with *D. ricinus* (Linnaeus). It may prove eventually to be another, moderately rare color phase of that variable species. Although an occurrence of *D. elegans* in the Society Islands is probable, the cited record requires confirmation; specimens from that locality in the Academy of Natural Sciences of Philadelphia and the National Museum of Natural History, Washington, lack exact locality data.

Habitat—Only five specimens were taken by the operation "Crossroads" in 1946 and the biological re-survey in 1947 of the Marshall Islands. These were found living in association with the extremely common yellow-spotted and white color phases of *Drupa ricinus*. On Niue Island, the species is also sympatric with *D. ricinus* and has been collected on reefs under cliff overhangs (D. C. Johnson, personal commun.).

Description—Shell 13 to 25 mm (about $\frac{1}{2}$ to 1 inch) in length, sub-ovate, spire short; body whorl spirally ribbed with five rows of siphonous

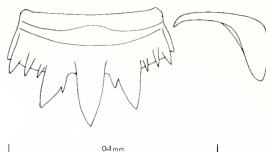


Plate 19. Radula of *Drupa (Drupa) elegans* (Broderip and Sowerby). Half a transverse row; Vailoa, Alofi Bay, Niue Id.

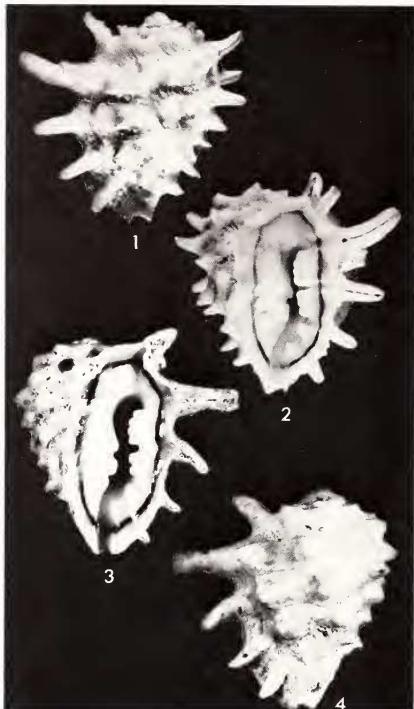


Plate 20. *Drupa (Drupa) elegans* (Broderip and Sowerby). Figs. 1, 2. Lectotype from unknown locality (B.M. (N.H.), 20.3 x 22.4 mm) [photo courtesy J. Taylor, B. M. (N.H.)]. Figs. 3, 4. Specimen from Vailoa, Alofi Bay, Niue Id. (WOC coll.; 19.0 x 20.7 mm).

tubercles. Interstitial surface minutely scaled. Parietal shield moderately enameled, reflected over body wall to form a heavy callus; lower portion of columella 4 plaited. Axial fold strongly developed. Aperture very narrow, dentition of

outer lip as in *Drupa ricinus* (Linnaeus). Color of the exterior and aperture white; aperture encircled by a continuous dark reddish brown line in mature specimens; in juvenile specimens, the line is disrupted and restricted to the columellar lip and near the anal siphonal canal.

Radular ribbon very small, side-cusps of the rachidian bifid, followed by 3 slender and deeply rooted lateral denticles, exclusive of the short end-cusps.

Measurements (mm)—(including spines; all specimens with a mature lip)

length	width	
25.0	25.0	Wake Island
20.3	22.3	Lectotype of <i>elegans</i> B. and S.
19.0	20.7	Nine Id.
18.5	17.5	Lord Hood Id. (S. Marutea Id.)
13.6	11.8	Lord Hood Id. (S. Marutea Id.)

Synonymy—

- 1829 *Ricinula elegans* Broderip & Sowerby, Zoological Journal, London, vol. 4, p. 376 (no locality given); 1839 Gray, Zool. Capt. Beechey's voyage, p. 155, pl. 36, fig. 4; 1844 Deshayes & Milne-Edwards, Hist. nat. anim. s. vertébrés, ed. 2, vol. 10, p. 52; 1846 Reeve, Conchologia Iconica, vol. 3, pl. 1, fig. 1 (Lord Hood Id. = South Marutea Id.); 1933 Dautzenberg & Bouge, Journal de Conchyliologie, vol. 77, p. 238.
 1853 *Pentadactylus elegans* Broderip, H. & A. Adams, Genera Recent Mollusca, vol. 1, pp. 129, 130; vol. 3, pl. 13, figs. 6a, b (operculum only).
 1880 *Ricinula ricinus* var. *elegans* Broderip, Tryon, Manual of Conchology, vol. 2, p. 184, pl. 56, fig. 193.
 1913 *Drupa ricinus* var. *elegans* Broderip & Sowerby, Hedley, Nautilus, vol. 27, no. 7, p. 80.
 1957 *Drupa elegans* Broderip & Sowerby, Kaicher, Indo-Pacific Sea Shells, (Muricaceae, Buccinaceae), pl. 3, fig. 18.

Types—Three syntypes of *Drupa elegans* are in the British Museum (Nat. Hist.), and the 20.3mm long syntype (Pl. 20, figs. 1, 2) is here selected

as the lectotype. The species was described from shells in the Museum of the Zoological Society brought home by Lieutenant Belcher who sailed under Captain Beechey in the "Blossom" on its voyage to the Bering Straits and the Pacific (1825-1828). No type locality was given, but Cuming collected it from Lord Hood Island (= S. Marutea Id.), and his specimen was figured by Reeve (1846). Lord Hood Island (= S. Marutea Id.) is here designated as the type locality.

Records—WAKE ISLAND: (BPBM). MARSHALL ISLANDS: Namu Id., N. W. end of Bikini Id.; Eniman Id., Bikini Atoll; Eniwetok Atoll (all USNM). LINE ISLANDS: Caroline Id.; Flint Id. (both ANSP). NIUE ISLAND: (AMNH); Vailoa, Alofi Bay (D. C. Johnson coll.); WOC coll.; Avatele (S. Herriot coll.). COOK ISLANDS: Akamaru Id., Manihiki Atoll (ANSP). SOCIETY ISLANDS: (ANSP; USNM). TUAMOTU ISLANDS: Lord Hood Id. (= S. Marutea Id.) (AMNH; BMNH); Vahitahi; Nengonengo Id. (both USNM); Anaa Id. (MCZ); Napuka; Taenga; Fakahina (Dautzenberg & Bouge, 1933, p. 238).

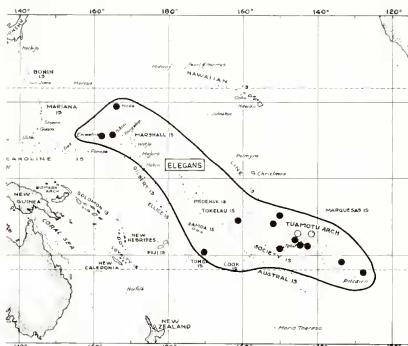


Plate 21. Geographical distribution of *Drupa* (*Drupa*) *elegans* (Broderip and Sowerby). Open circles are literature records.

[These occasional blank areas occur between genera and subgenera to permit the insertion of new material and future sections in their proper systematic sequence.]

Drupa rubusidaeus Röding, 1798

(Pl. 2, figs. 13-15; Pls. 22, 23)

Range—From the Red Sea and East Africa throughout the Indo-Pacific to Hawaii and the Tuamotu Islands.

Remarks—This solid species could only be confused with the much smaller and rarer *Drupa speciosa* (Dunker). *D. speciosa* is a higher-spired shell with no yellow coloration in the aperture; the pink coloring of the aperture is more pronounced and the denticles of the outer lip are more closely set and almost grouped.

Habitat—On algae matted reef-flats, under rocks and in tide-pools, generally on the seaward half of the reef-flat; from low tide to a depth of 10 fathoms or more, on rock, sand or coral. In the Hawaiian Islands the species has been collected attached to stony coral at a depth of 50 to 60 feet (C. S. Weaver, leg.).

Description—Shell 20 to 55 mm (3/4 to 2 1/4 inches) in length, solid, ovately globose, slightly ventricose, spire short, acuminate, body whorl large and with five rows of strong, sub-spiniform, siphonous tubercles. Sculpture of fine, scale like

Subgenus Ricinella Schumacher, 1817Type: *Drupa rubusidaeus* Röding, 1798

Shell sub-ovate, solid, spire rather short; body whorl large, whorls spirally ribbed, sculptured with siphonous spiniform tubercles; interstices filled with fine scale-like plates forming raised threads; threads running spirally in close parallel association; columella with an axial fold, outer lip dentate with teeth singularly arranged, sometimes in close association, not compound; operculum subelliptical, not linear; radula typical for the genus.

This group includes besides the type species, *Ricinula speciosa* Dunker, 1867, *R. clathrata clathrata* Lamarck, 1816, and *R. clathrata miticula* Lamarck, 1822. On the basis of radular characters, the group shows a close relationship with *Drupa sensu stricto*. The shells on the other hand resemble some of the thaidids. The members of this group have the labial teeth developed as small, pearl-like teeth which may be closely crowded together as in *Drupa clathrata* or *D. speciosa*, but are never actually compound.

The interpretation of the identity of the type species of *Ricinella*, i.e. *R. purpurata* Schumacher, rests on the elucidation of the cited illustration of Favanne (1784, pl. 24, fig. 2). This figure resembles *D. rubusidaeus* Röding more so than *D. clathrata* (Lamarck). Favanne's description of the color of the aperture as being deep and vivid lilac or purple, excludes the species *D. clathrata* from consideration.

Synonymy—

1817 *Ricinella* Schumacher, Essai nouv. système, pp. 72, 240. Type-species by subsequent designation, Iredale, 1937: *Ricinella purpurata* Schumacher, 1817 [= *Drupa rubusidaeus* Röding, 1798].



Plate 22. Radula of *Drupa (Ricinella) rubusidaeus* Röding. Half a transverse row; Olawala, Maui, Hawaiian Ids.



Plate 23. *Drupa (Ricinella) rubusidaeus* Röding.

Fig. 1. Lectotype figure of *D. (R.) rubusidaeus* Röding, from Knorr, 1768, pt. 6, pl. 24, fig. 7.

Fig. 2. Holotype of *Ricinella reeveana* Crosse, from Nukuhiva, Marquesa Ids. (B.M. (NH); 48.2 x 38.8 mm—immature specimen).

plates forming ridges which run spirally in parallel association between the rows of tubercles. Aperture sub-elliptical, outer lip in adult stage dentate with 7-12 small pearl-like teeth; margin crenulated, apertural area enameled; enameled area extending over a large portion of the body whorl adjacent to the aperture. Inner lip calloused with 3 or 4 plications. Siphonal canal short, deep, recurved; sutural canal conspicuous, always open. Color white-yellowish externally, margin of the aperture yellow, interior of the aperture rich pink.

The side-cusps of the rachidians of the radula are bifid to trifid and are followed by 2-3 lateral denticles, exclusive of the stronger side-cusps.

Measurements (mm)—(including spines; all specimens with a mature lip)

length	width	
53.8	48.5	Oahu, Hawaiian Ids.
48.2	38.8	Holotype of <i>reeveana</i> Crosse
41.6	38.9	Luzon Id., Philippines
34.0	28.7	Niue Id., Polynesia
28.8	25.0	Koror Id., Palau Ids.

Synonymy—

- 1742 — Gualtieri, Ind. test. Conchyliorum, pl. 28, fig. R (poor).
- 1758 — Regenfuss, Aus. Schnecken, Muscheln u.a.Schaal-thiere, (1), pl. 3, fig. 32.
- 1768 — Knorr, Verg. Augen U. Gemüths, pt. 6, pl. 24, fig. 7 (very good).
- 1777 "Murex hercicus" Martini, Syst. Conchylien-Cabinet, vol. 3, p. 283, pl. 101, figs. 974, 975 (poor). [non-binomial].
- 1780 — Favanne, La Conchyliologie . . . ed. 3 [of d'Argenville], pl. 24, fig. A2 (poor).
- 1784 — Favanne, Catalogue systematique et raisonné . . . p. 145 (description).
- 1791 *Murex nodus* Gmelin, Systema Naturae, ed. 13, p. 3537 (refers to Knorr, *op. cit.*, with a query) [no locality given] (*non* Linnaeus, 1758).
- 1798 *Drupa rubusidaeus* Röding, Museum Boltenianum, p. 55 (refers to Martini, *op. cit.*, and Knorr, *op. cit.*) [no locality given]; 1913 Hedley, Nautilus, vol. 27, no. 7, p. 80; 1966 Weaver, Hawaiian Shell News, vol. 14, no. 14, p. 2, textfigs. 1, 2; 1969 Cernohorsky, Veliger, vol. 11, no. 4, p. 301, pl. 47, figs. 10, 10a; 1971 Wilson & Gillet, Australian Shells, p. 92, pl. 61, figs. 1, 1a.
- 1798 *Drupa fragum* Röding, Museum Boltenianum, p. 55 (refers to *Murex nodus* Gmelin, 1791, sp. 42) [no locality given].
- 1807 *Mancinella hystrix* Link, Beschr. Nat.-Sammel. Univ. Rostock, 3 Abth., p. 115 (refers to Martini, *op. cit.*) [*non* *Murex hystrix* Linnaeus, 1758].
- 1817 *Ricinella purpurata* Schumacher, Essai nouv. système, p. 240 (refers to Favanne, *op. cit.*) [no locality given].
- 1817 *Murex hystrix* Linnaeus, Dillwyn, Desc. cat. Rec. shells, vol. 2, p. 706 (refers to Martini, Gualtieri, Regenfuss etc.) [East Indian Seas; coasts of the Friendly Islands = Tonga Ids.]; 1825 Wood, Index Testaceologicus, p. 124, pl. 26, fig. 50a (*non M. hystrix* Linnaeus, 1758).

- 1822 *Purpura hystrix* Lamarck, Hist. nat. anim. s. vertébrés, vol. 7, p. 247 (refers to Knorr, Regenfuss, Martini and Gualtieri, *op. cit.*); 1835 Kiener, Spéc. gén. icon. coq. viv., vol. 8, p. 13, pl. 2, figs. 4, 4a, b; 1846 Reeve, Conchologia Iconica, vol. 3, pl. 3, fig. 13 (*non Murex hystrix* Linnaeus, 1758).
- 1825 *Murex hippocastanum* Wood, Index Testaceologicus, p. 124, pl. 26, fig. 53a (*non* Linnaeus, 1758).
- 1832 *Purpura spathulifera* Blainville, Nouv. Ann. Mus. d'Hist. Nat. Paris, ser. 3, vol. 1, p. 212, pl. 9, fig. 8 (no locality given).
- 1833 *Purpura hystrix* (*sic*) Lamarck, Quoy & Gaimard, Voyage L'Astrolabe, vol. 2, p. 575, pl. 39, figs. 14-16 (animal and operculum).
- 1853 *Pentadactylus hystrix* H. & A. Adams, Gen. Rec. Molusca, vol. 1, p. 130; 1875 Troschel, Gebiss d. Schnecken, vol. 2, p. 134, pl. 13, fig. 4 (radula).
- 1862 *Ricinula reeveana* Crosse, Journal de Conchyliologie, vol. 10, p. 47, pl. 1, fig. 3 (Nouhiva = Nukuhiva, Marquesas Ids.) [immature specimen] (*non Ricinula reeveana* C. B. Adams, 1852).
- 1880 *Ricinula hystris* Linnaeus, Tryon, Manual Conchology, vol. 2, p. 183, pl. 56, fig. 195; 1933 Dautzenberg & Bouge, Journal de Conchyliologie, vol. 77, p. 239.
- 1880 *Ricinula hystris* var. *reeveana* Crosse, Tryon, *ibid.*, vol. 2, p. 183, pl. 56, fig. 196; 1933 Dautzenberg & Bouge, *ibid.*, vol. 77, p. 239 (non C. B. Adams, 1852).
- 1911 *Sistrum hystrix* Linnaeus, Schepman, Siboga-Expedition, vol. 49d, p. 354 (*non Murex hystrix* Linnaeus, 1758).
- 1913 *Drupa rubusidaeus* Bolten, Hedley (*paras.*), The Nauillus, vol. 27, no. 7, p. 79.
- 1936 *Drupa spathulifera* (Blainville), Hirase, Coll. Jap. shells, ed. 5, p. 79, pl. 110, fig. 9; 1954 Kira, Col. illust. shells Japan, p. 47, pl. 23, fig. 4; 1967 Habe & Kosuge, Stand. book Jap. shells color, vol. 3, p. 70, pl. 27, fig. 24; 1968 Taylor, Phil. Trans. Roy. Soc. London, ser. B, vol. 254, p. 201.
- 1938 *Drupa (Drupa) hystrix* (Linnaeus), Adam & Leloup, Mém. Mus. Roy. d'Hist. Nat. Belgique, vol. 2, fasc. 19, p. 163.
- 1957 *Drupa rubusicaeus* Kaicker, Indo-Pacific Sea Shells (Muriceacea, Buccinacea), pl. 3, fig. 15 (*non D. rubusicaeus* Röding, 1798).
- 1961 *Drupa rubusicaeus* Röding, Rippingale & McMichael, Queensland and Gt. Barrier Reef Shells, p. 102, pl. 13, fig. 3 (*non D. rubusicaeus* Röding, 1798).
- 1962 *Drupa rubusicaeus* (Röding), Kira, Shells West. Pacific in color, vol. 1, p. 62, pl. 24, fig. 4; 1965 Ara-kawa, Venus: Jap. Journ. Malacology, vol. 24, no. 2, p. 115, pl. 13, figs. 5, 6 (radula) [*non* Röding, 1798].
- 1965 *Drupa speciosa* (Dunker), Wu, Bull. Inst. Zool. Acad. Sinica, vol. 4, p. 98, textfig. 30 (radula) (*non Ricinula speciosa* Dunker, 1867).
- 1967 *Drupa rubusidaeus* Röding, Orr Maes, Proc. Acad. Nat. Sci. Philadelphia, vol. 119, no. 4, p. 129.

Types—Röding's type specimen of *Drupa rubusidaeus* is lost, and we therefore select the specimen figured by Knorr on plate 24, fig. 7, as the lectotype of the species (Pl. 23, fig. 1), and designate Davao Bay, Mindanao, Philippines, as the type locality. The type specimen of *Purpura spathulifera* Blainville, is probably in the Muséum National d'Histoire Naturelle, Paris, and the holotype of *Ricinula reeveana* Crosse, is in the British Museum (Nat. Hist.) [Pl. 23, fig. 2]. The type specimen of *Ricinella purpurata* Schu-

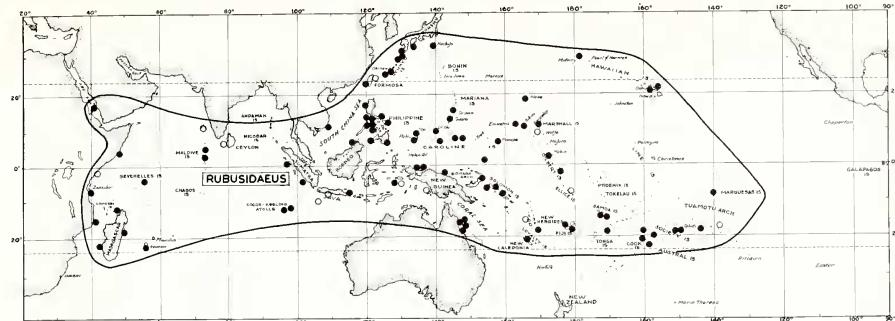


Plate 24. Geographical distribution of *Drupa (Ricinella) rubusidaeus* Röding. Open circles are literature records.

macher, could not be located in the Zoological Museum, Copenhagen (J. Knudsen, *in litt.*).

Nomenclature—This species was at first masquerading under the names *Mancinella hystrix* Link, *Murex hystrix* Dillwyn and *Purpura hystrix* Lamarck. As previously discussed, this is not *Murex hystrix* Linnaeus, 1758. Since Röding, 1798, cites 2 of the 4 references which Lamarck considered synonyms of *Purpura hystrix*, there can be no doubt regarding the identity of his species. Röding's citation to Knorr's excellent figure (designated as lectotype) of the present species, as well as Martin's figures, serves to establish the identity of *D. rubusidaeus*.

More recently Hedley (1913) confused *Purpura spathulifera* Blainville, a species which he synonymized with *Drupa rubusaeus* Röding, *Ricinula clathrata* Lamarck, and *R. speciosa* Dunker, but which is conspecific with *D. rubusidaeus*. The specimen and its figured radula cited by Wu (1965a) as "*Drupa speciosa* (Dunker)" originated from Wan-li-tong, Taiwan, and is actually *D. rubusidaeus* Röding (*Wu in litt.*).

Records—RED SEA: (AMNH). EAST AFRICA: Gesira, Somalia (ANSP); Diani Beach, Kenya (Heimke, 1970, p. 7); Kendwa Id., 4 mi ESE of Dar-es-Salaam; Sinda Id., 15 mi SSE of Dar-es-Salaam; N.W. of Magogani; Pangavini Id., 10 mi NNE of Dar-es-Salaam, all Tanzania (all MCZ); Mozambique (USNM). SEYCHELLES ISLANDS: Beau Vallon Beach, Mahe; Cousin Id. (both ANSP). MADAGASCAR: Nosy N'Tangant, W. Nossi Bé; Grande Recife, W. of airport, Tuléar; Ambodifotora (all MCZ). REUNION ISLAND: (ANSP). MALDIVE ISLANDS: Miladummadulu Atoll; Tila-dummati Atoll; N. Male' Atoll (all ANSP). LACCADIVE ISLANDS: (Homell, 1922, p. 217). CEYLON: (Langdon, 1875, p. 72). VIETNAM: Cam Ran Bay (ANSP). COCOS-KEELING ISLANDS: Klapetjui, West Id. (USNM); S. end of Home Id.; N. end of Horsburgh Id.; S. end of Direction Id. (all ANSP). CHRISTMAS ISLAND: (Tonlin, 1935, p. 79). INDONESIA: Mandi Darrah Id., N. Borneo (AMNH);

(ANSP); Pulau Bai, Batu group, off Sumatra; Pulau Penju, S. Sumatra (both USNM); Bali Id.; Wasi, Ambon Id. (both FMNH); Banda Id., Soengai Manoenbai, Iles Aroe (Adam & Leloup, 1938, p. 164); Tjilaoet, Java (Altena, 1945, p. 146). PHILIPPINES: Iba, Zambales, Luzon Id.; Borongan village, E. Samar Id.; Cuyo Id., Palawan group (all ANSP); Tilig reef, Lubang Id.; Calapan, Mindoro; Lingayen Gulf; Davao Bay, Mindanao (all AMNH); Nogas Point, Panay Id.; Cabra Id.; Silino Id.; Poin Matangal, Basilan, Sulu (all USNM). FORMOSA (Taiwan): Wan-li-tong (AMNH); Karenko; Botan-wan Ryuku-syo; Hoko (Kuroda, 1941, p. 111). RYUKYU ISLANDS: Yomitan reef, Okinawa (AMNH); Okuma, Kunigami-Gun; Bolo reef, N.W. Nakagami-Gun (both USNM); Ishigake (MCZ); Miyako (FMNH). JAPAN: Hachijo Id., 275 mi. S. of Tokyo; Tosa, Shikoku; Kagoshima, Kyushu (all ANSP); Ominato Ise (AIM); Oshima, Osumi (Powell coll.). MARIANAS: Saipan (AMNH); Agana Bay, Guam Id. (ANSP). PALAU ISLANDS: Babeluap Id.; Angupolu Id., S.E. of Koror; Malakal Harbour, Koror; Helen Channel (all ANSP). CAROLINE ISLANDS: Kayang; Ngargersiu; SW. of Rattakadokoru; S. of Garakayo; Ulithi; Ella; Elangalap Id.; Iahlu Atoll; Tirakaum; Ringutoru; Kapingamarangi (all ANSP); Ponape reef (AMNH). WAKE ISLAND: (BPBM). MARSHALL ISLANDS: Eniwetok Atoll; Bikini Atoll; Rongerik Atoll (all USNM); Kwajalein Atoll (Dietrich & Morris, 1953, p. 15). NEW GUINEA: Biak Id., Schouten Ids. (USNM); 1 mi. NE of Mioc Woendi, Padaido Ids. (Powell coll.); Wewak (ANSP). NEW BRITAIN: Rabaul Harbour (AMNH). AUSTRALIA: Queensland: Herald Cay, Coral Sea; Holmes reef, Coral Sea; off Cairns, Watt reef, off Townsville (all AMS); Green Id., off Cairns (AIM); several islands of the Capricorn group (AMS; AMNH). SOLOMON ISLANDS: Choiseul Bay, Choiseul Id.; Bougainville Id.; Bellona Id. (all AMNH); Fiu, Malaita Id. (Powell coll.). NEW HEBRIDES: Efate Id. (Colardeau coll.); Espiritu Santo (Solem, 1959, p. 262). NEW CALEDONIA: Touho (AMNH). GILBERT ISLANDS: Abaang (MCZ); Kingsmill Ids. (AMNH). ELLICE ISLANDS: Funafuti lagoon (AIM). FIJI ISLANDS: (AMNH; ANSP); Rat Tail Passage, Suva reef, S. Viti Levu (WOC coll.); Mamanuca group (Jennings coll.). NIUE ISLAND: (DM); Tuapa reef (AMNH; WOC coll.). SAMOA ISLANDS: reef at Satalo Id., Upolu Id.; E. side of Wailele Bay, Upolu Id. (both ANSP); Nuuli, Tutuila Id. (MCZ). COOK ISLANDS: Mauke; Aitutaki (both USNM); off Aroa Creek, S.W. Rarotonga; Koromiri Id., S.W. Rarotonga (both MCZ); Mangaia (DM). SOCIETY ISLANDS: Several localities on Tahiti and Moorea (USNM). TUA-MOTU ISLANDS: Anaa Id. (AMNH; ANSP; MCZ); Amanu (Contourier, 1907, p. 143). MARQUESAS ISLANDS: (MCZ); Nukuhiva (BMNH). LINE ISLANDS: Fanning Id. (DMNH). HAWAIIAN ISLANDS: Midway Id.; off Waikiki, Oahu (both

AMNI); Makaha Point, S.W. Oahu (MCZ); Olawala, Maui (AMNH).

Fossil records—KENYA: Pleistocene; raised reef, S.E. of Mombassa Id., N. of Ras Serani (Cox, 1930, p. 145). HAWAIIAN ISLANDS: Oahu Id. (Kosuge, 1969, p. 786, pl. 5, fig. 94).

Drupa speciosa (Dunker, 1867)

(Pl. 2, figs. 21, 22; Pl. 25)

Range—Tuamotu and Pitcairn Islands.

Remarks—The shell of this Polynesian species is smaller and higher-spired than *D. rubusidaeus* Röding, with a deeper pink to mauve aperture which lacks the yellow coloration found in the aperture of the larger species. Specimens labelled "Fiji Islands" are obviously based on erroneous locality indications as the species does not occur there. The record from Rarotonga, Cook Islands (ANSP) is also suspect, and has not been confirmed by recently collected, well-documented specimens.

Habitat—Unknown, but probably found on coral reefs at low tide.

Description—Shell 20 to 29 mm ($\frac{3}{4}$ to $1\frac{1}{4}$ inches) in length, solid, ovate, globose; spire moderately elevated, acuminate; body whorl axially ribbed with 9 ribs, crossed by 5 transverse rows of short, strong, spinose tubercles. Interstices between tubercles striated with parallel rows of small scales. Aperture subelliptical, columella posteriorly excavated, outer lip dentate with 4-7 evenly spaced small white teeth; margin crenulated. Inner lip with 3 strong lower plications and 1 subobsolete upper plication. Apertural area enameled, enameled area of the inner lip extending over a portion of the body whorl. Anterior siphonal canal short, deep; posterior siphonal canal open. Color creamy-white externally, aperture a deep mauve pink.

Radula unknown. The radular dentition figured by Wu (1965a) for this species was based on a specimen of *D. rubusidaeus* from Taiwan (Wu, *in litt.*).

Measurements (mm)—(including spines; all specimens with a mature lip)

length	width	
27.0	21.5	Tuamotu Ids.
26.9	23.2	Lectotype of <i>speciosa</i> Dunker
26.4	20.8	Rarot., Tuamotu Ids.
25.4	21.7	Vahitahi, Tuamotu Ids.
22.8	18.9	Vahitahi, Tuamotu Ids.
21.9	16.3	Vahitahi, Tuamotu Ids.
20.1	14.8	Tuamotu Ids.

Synonymy

- 1846 *Ricinula clathrata* Lamarck, var. B., Reeve, Conchologia Iconica, vol. 3, pl. 2, fig. 9a (Anaa Id.) [non *R. clathrata* Lamarck, 1816].
- 1867 *Ricinula speciosa* Dunker, Novitates Conchologicae, Abt. II, pts. 11/12, p. 100, pl. 33, figs. 7, 8, 1878 Dunker, Addenda & Corrigenda, p. 139 (Philippine Ids. = error) [non *Purpura speciosa* Valenciennes, 1832].
- 1880 *Ricinula hystrix* var. *speciosa* Dunker, Tryon, Manual Conchology, vol. 2, p. 183, pl. 56, fig. 194; 1933 Dautzenberg & Bouge, Journal de Conchyliologie, vol. 77, p. 239.
- 1969 *Drupa speciosa* Dunker, Cernohorsky, Veliger, vol. 11, no. 4, pp. 301, 302.

Types—Dunker described the species from 4 specimens in Hugh Cuming's collection which is now in the British Museum (Nat. Hist.). Three of the syntypes are immature examples with weak denticles on the outer lip and a superficial columellar callus. Only one specimen is reasonably mature, and this specimen is here selected as the lectotype of *Ricinula speciosa* Dunker (Pl 25, fig. 1). Even though the selected lectotype is without

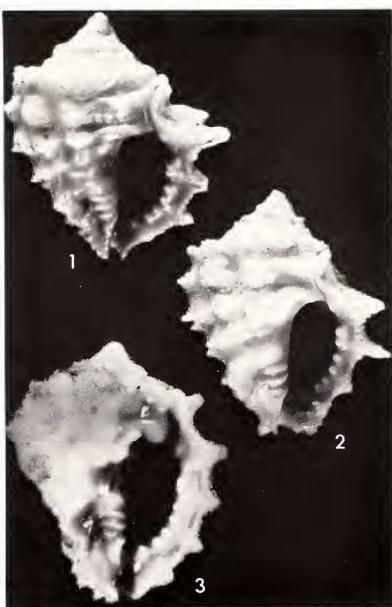


Plate 25. *Drupa (Ricinella) speciosa* (Dunker).

Fig. 1. Lectotype (B.M. (NH); 26.9 x 23.2 mm).
 Fig. 2. Syntype; immature (B.M. (NH); 26.9 x 21.9 mm)
 [photos courtesy K. Way, B.M. (NH)].
 Fig. 3. Specimen from Vahitahi, Tuamotu Ids. (USNM 613343; 22.8 x 19.0 mm).

question the *Drupa speciosa* of authors, the specimen does not compare too well with Dunker's original type-figure. Either the artist exercised his own imagination when depicting the specimen, or the originally illustrated example has gone astray. Stability of the taxon *Drupa speciosa*, however, is best served by the selection of the most mature specimen from among the 4 syntypes, which all are the *D. speciosa* of Dunker and of authors. Dunker gave the erroneous type locality as "Philippine Islands," which is here corrected to Anaa Island, Tuamotu Islands. Reeve's figure is based on a specimen in the Cuming collection from this locality.

Nomenclature—Reeve in 1846 figured this species, calling it *Ricinula clathrata* Lamarck, variety B, and both Crossé (1862) and Dunker (1867) in describing *reeveana* and *speciosa* respectively, cite Reeve's figures in synonymy. However, *R. reeveana*, which is preoccupied (*non* C. B. Adams, 1852), has been shown to be a synonym of *D. rubusidaeus* Röding, leaving Dunker's name available for the present taxon.

Records—TUAMOTU ISLANDS: (USNM; ANSP; FMNH; AMS); Garumaoa; Mataira; Oneroa; Opakea, all Rarotonga Atoll (USNM); Anaa Id. (MCZ); Vahitahi (USNM); Fangatau; Makatea (Dautzenberg and Bouge, 1933, p. 239). PITCAIRN ISLAND: Oeno Island (USNM).

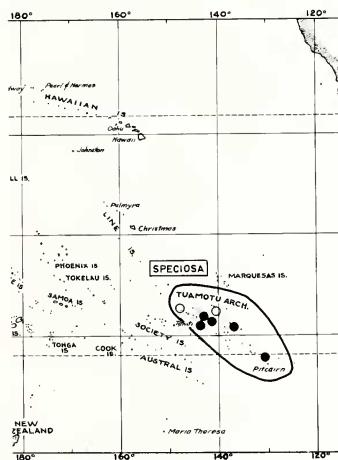


Plate 26. Geographical distribution of *Drupa (Ricinella) speciosa* (Dunker). Open circles are literature records.

Drupa clathrata clathrata (Lamarck, 1816)

(Pl. 2, figs. 16-18; Pls. 27, 28)

Range—From Japan and the Philippines to the Marquesas and Pitcairn Islands.

Remarks—The large number of spines, rugose columella and apertural coloration serve to characterize this species. Populations occurring in the Indian Ocean are separable on shell morphology and are recognized as a subspecies, *D. clathrata miticula* (Lamarck).

Habitat—On reefs, in crevices and under coral rocks, intertidal.

Description—Shell 16 to 57 mm (2/3 to 2 1/4 inches) in length, ovate and solid, spire short; body whorl large, crossed by five rows of spiral ribs. Ribs with siphonal, spiny tubercles; tubercles higher towards the margin of the outer lip. Spiral ribs connected by low axial ribs to form shallow pockets in the interstices. Surface sculptured with fine spirally arranged scales. Aperture subelliptical, columella excavated posteriorly, with 4 to 5 small plications above the siphonal canal. Parietal shield thinly enameled, reflected to form an irregular callus. Sutural canal well developed as a groove turned toward the spire. Axial fold strong, extending the length of the columella and terminating as a margin of the siphonal canal. Outer lip dentate with 4 to 5 singularly arranged teeth which sometimes become united. Color brownish-white externally, margin of aperture spotted with brown, interior of aperture a light violet. Operculum typical of group.

The radula has the side-cusps of the rachidian bifid or trifid, and there are 2 to 3 deeply rooted lateral denticles, exclusive of the end-cusps.

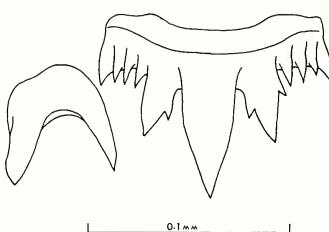


Plate 27. Radula of *Drupa (Ricinella) clathrata clathrata* (Lamarck). Half a transverse row; Pango Point, Efate Id., New Hebrides.



Plate 28. Figs. 1, 2, *Drupa (Ricinella) clathrata clathrata* (Lamarck); Fig. 3, *D. (R.) clathrata miticula* (Lamarck).

Fig. 1. Holotype of *Ricinula clathrata* Lamarck (MHNG no. 1101/14/1; 30.4 x 31.2 mm).

Fig. 2. Specimen of *Drupa (Ricinella) clathrata clathrata* (Lamarck), from Pango Point, Efate Id., New Hebrides (WOC coll.; 28.3 x 25.8 mm).

Fig. 3. Lectotype of *Ricinula miticula* Lamarck (MHNG no. 1101/13/1; 26.3 x 21.0 mm).

Measurements (mm)—(including spines; all specimens with a mature lip)

length	width	
57.3	53.0	"South Seas"
42.8	38.2	"Central Pacific"
35.7	29.0	Suva reef, Fiji Ids.
32.2	24.6	Samar Id., Philippines
30.4	31.2	Holotype of <i>clathrata</i> Lamarck
23.1	20.0	Tacume Id., Tuamotu Ids.
21.0	18.5	Pango Pt., New Hebrides

Synonymy—

- 1816 *Ricinula clathrata* Lamarck, Tableau Encycl. Méthodique, p. 2, pl. 395, figs. 5a, b (no locality given); 1822 Lamarck, Hist. nat. anim. s. vertébrés, vol. 7, p. 231; 1846 Reeve, Conchologia Iconica, vol. 3, pl. 2, fig. 9b only (Elizabeth Id., = Tuamotu Ids.); 1859 Chemu, Manuel de Conchyliologie, vol. 1, p. 168, textfig. 816; 1933 Dautzenberg & Bouge, Journal de Conchyliologie, vol. 77, p. 237.

- 1835 *Purpura clathrata* Lamarck, Kiener (pars), Spéc. gén. icon. coq. viv., vol. 8, p. 15, pl. 3, fig. 5 only.
- 1853 *Pentadactylus clathratus* Lamarck, H. & A. Adams, Gen. Rec. Mollusca, vol. 1, p. 130; 1875 Troschel, Gébris d. Schnecken, vol. 2, p. 133, pl. 13, fig. 3 (radula).
- 1880 *Ricinula hystrix* var. *clathrata* Lamarck, Tryon, Manual Conchology, vol. 2, p. 184, pl. 56, figs. 197, 198.
- 1913 *Drupa rubuscaesia* Bolten, Hedley (pars), Nautilus, vol. 27, no. 7, p. 80 (non *D. rubuscaesius* Röding, 1795).
- 1936 *Drupa rubuscaesia* Röding, Hirase, Coll. Jap. shells, p. 79, pl. 110, fig. 10; 1957 Kaicher, Indo-Pacific Sea Shells (Muricaceae, Buccinaceae), pl. 3, fig. 15 (non *D. rubuscaesius* Röding, 1795).
- 1951 *Drupa rubuscaesius* Röding, Hirase & Takei, Handb. illust. shells colour, pl. 110, fig. 10; 1959 Kira, Col. illust. shells of Japan, vol. 1, p. 58, pl. 23, fig. 9 (non Röding, 1795).
- 1954 *Drupa rubuscaesium* Röding, Kira, Col. Illust. shells of Japan, pl. 23, fig. 9 (non *D. rubuscaesius* Röding 1795).
- 1962 *Drupa rubuscaesius* (sic) Röding, Kira, Shells west. Pacific in colour, p. 63, pl. 24, fig. 9 (non *D. rubuscaesius* Röding, 1795).
- 1965 *Drupa rubuscaesius* Röding, Arakawa, Venus: Jap. Journ. Malacology, vol. 24, no. 2, p. 115, pl. 13, fig. 7 (radula) [non Röding, 1795].
- 1967 *Drupa (Ricinella) rubuscaesius* (Röding), Habe & Kosuge, Stand. book Jap. shells in color, vol. 3, p. 70, pl. 27, fig. 29 (non Röding, 1795).
- 1969 *Drupa clathrata* (Lamarck), Cernohorsky, Veliger, vol. 11, no. 4, p. 298, pl. 47, fig. 6.

Types—The holotype of *Ricinula clathrata* Lamarck, is in the Muséum d'Histoire Naturelle, Geneva, no. 1101/14/1 (Pl. 28, fig. 1). According to Rosalie de Lamarck's marginal annotations in her father's copy of the "Histoire naturelle des animaux sans vertébres," only a single specimen was present in Lamarck's collection at the time of description. In 1822 Lamarck gave the size of his specimen as 13½ lignes [= 30.4mm], and this dimension agrees with the larger specimen, which is considered the holotype, but not the smaller 29.7mm specimen which accompanies it. This latter specimen has probably been added at a later date. The type locality here designated is Tuamotu Islands (after Reeve, 1846), specifically Raroia Island (from which there are specimens in the ANSP).

Nomenclature—This species seems to have been confused with *Drupa rubuscaesius* Röding, and *D. rubuscaesius* Röding, by modern authors. Hedley (1913) initiated the confusion by suggesting that *Ricinula clathrata* Lamarck, *R. speciosa* Dunker and *Purpura spatulifera* Blainville, were synonyms of *Drupa rubuscaesius* Röding. Kira (1954, pl. 23, fig. 9; 1962, pl. 24, fig. 9) illustrates a specimen of *Drupa clathrata* with an immature lip and calls it in the first instance *D. rubuscaesius* Röding, and in the second instance *D. rubuscaesius* (sic) Röding. Kaicher (1957,

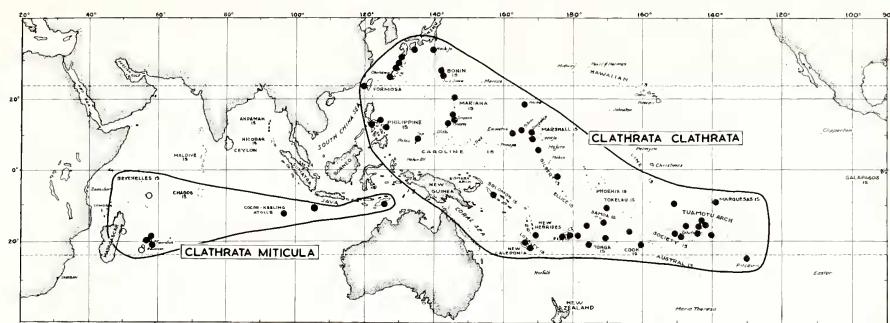


Plate 29. Geographical distribution of *Drupa (Ricinella) clathrata clathrata* (Lamarck) and its subspecies *D. (R.) clathrata miticula* (Lamarck). Open circles are literature records.

pl. 3, fig. 15) cites *D. clathrata* as a synonym of *D. rubuscaesia* Röding, although it is not clear to which species her figures refers. As discussed earlier, *Drupa rubuscaesius* Röding, is a synonym of *D. ricinus* (Linnaeus), for Röding refers to Martini's figure of the yellow apertured form of that species.

Records—PHILIPPINES: Gigmoto, Catanduanes Id. (AMNH; DMNH; AIM); Borongan village, E. Samar Id. (ANSP); Marinduque Id. (USNM). FORMOSA (Taiwan): Chaiting (Janowsky coll.). RYUKYU ISLANDS: Yakushima; Onna Beach, N. of Naha, Okinawa; Bolo Point, Zampa Misaki, Okinawa (all USNM). JAPAN: Hackijo Id., 275 mi. S. of Tokyo; Tosa, Shikoku; Kagoshima, Kyushu (all ANSP); Oshima, Osumi (USNM). BONIN ISLANDS: Chichi Shima (ANSP); Ani Jima (USNM). MARIANAS: Laguman Tanapag, Saipan Id.; Ngarguers Id. (both ANSP); off Leprosarium, SW Tinian Id. (MCZ); Aspurguan, Guam Id.; Ypao Point, Maug Id. (USNM). WAKE ISLAND: (ANIIJ). MARSHALL ISLANDS: (many atolls, see map); Eniwetok; Bikini; Rongelap; Kwajalein; Jaluit (all USNM). SOLOMON ISLANDS: Choiseul Bay, Choiseul Id. (AMNH). NEW HEBRIDES: Pango Point, Efate Id. (AIM). LOYALTY ISLANDS: Lifu (USNM; AMNH). NEW CALEDONIA: Touho (AMNH). GILBERT ISLANDS: Kingsmill Id. (USNM). FIJI ISLANDS: Cuvu Beach, S. Viti Levu (AMNH); Rat Tab Passage, Suva reef, S. Viti Levu (WOC coll.); SE of Onea Driki, Lau group (USNM). TONGA ISLANDS: Ha'ateihie reef, Tongatapu; Niuafo'ou (both USNM). NIUE ISLAND: (DMNH); Oneome reef; Utuks reef (both AMNH). Alofi (USNM). SAMOA ISLANDS: Tutuila Id. (ANSP); Swain's Id. (MCZ). Lalomalava, Savaii (DMNH). COOK ISLANDS: Bird's Id., Palmerston Atoll; North Id., Palmerston Atoll (both USNM); Avavaaroa Passage, S. Barotonga (ANSP). SOCIETY ISLANDS: Moorea; Venus Point, Tahiti (both AMNH); Punaavai, Tahiti (ANSP). TUAMOTU ISLANDS: Tacume; Rarotonga (both ANSP); Anaa Id. (AMS); Makemo; Tikahau; Vahitahi; Makatea (all USNM). MARQUESAS ISLANDS: Atuona Bay, Hiva-Oa Id. (ANSP). PITCAIRN ISLAND: (AMNH). LINE ISLANDS: Caroline Id. (ANSP); Jarvis (DMNH).

Drupa clathrata miticula (Lamarck, 1822)

(Pl. 2, figs. 19, 20; Pls. 28, 30)

Range—Madagascar to the Island of Timor in Indonesia.

Remarks—First described by Lamarck in 1822, the identity of this Indian Ocean form appears to have escaped notice for over a hundred years and in that interval has been recorded as typical *Drupa clathrata*. It lacks the brown coloration of the columella and inner and outer lips that characterize the nominate subspecies. *D. miticula* is also a smaller shell, with shorter spines. The Indian Ocean populations have a more pronounced purple color in the aperture than those of the nominate subspecies which is lavender to whitish purple. The exterior lacks the black spines of *D. morum*.

Habitat—In tide pools, basalt rock, weed and some coral, and on sand and grass, from 0 to 8 feet. In the Cocos-Keeling Islands the species was found in "strong surf on a large boulder on the northern seaward reef at Horsburgh Island" (V. Orr Maes, personal communication). On Christmas Island it was found among *Caulerpa*

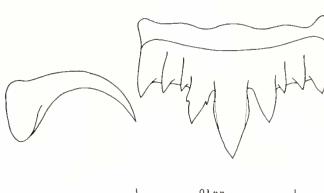


Plate 30. Radula of *Drupa (Ricinella) clathrata miticula* (Lamarck). Half a transverse row; Greta Beach, Christmas Id., Indian Ocean.

mats and in rock and tide-pools (leg. A. Slack-Smith and A. Patterson).

Description—Shell 16 to 38 mm ($\frac{3}{4}$ to 1 $\frac{1}{2}$ inches) in length, ovate, globose, spire short, acuminate. Body whorl large with six transverse rows of short tubercles. Interstices between tubercles striated with four to six rows of closely spaced granules. Aperture moderately wide, oval, over three-quarter of shell length. Outer lip crenulated between tubercles, inner margin dentate with six small white teeth from which six conspicuous white raised lines run into the aperture. Inner lip enameled with three to four plait-like ridges projecting into the aperture. Columella excavated posteriorly. Posterior siphonal canal open, obliquely curved toward the apex. Color pale brown on the exterior, interior of aperture purple.

In the radula examined, one of the side-cusps of the rachidian was trifid while the other one was simple; there were 2 lateral denticles apart from the end-cusps.

Measurements (mm)—(including spines; all specimens with a mature lip).

length	width	
38.0	31.3	Christmas Id., Indian Ocean
34.3	28.0	S. Mahébourg, Mauritius
32.5	26.0	S. Mahébourg, Mauritius
26.3	21.0	Lectotype of <i>miticula</i> Lamarck
17.0	13.8	Christmas Id., Indian Ocean
16.5	14.5	Souillac, Mauritius

Synonymy—

- 1822 *Ricinula miticula* Lamarck, Hist. Nat. anim. s. vertébres, vol. 7, p. 231 (no locality given); 1832 Blainville, Nouv. Ann. Mus. d'Hist. Nat. Paris, ser. 3, vol. 1, p. 211; 1844 Deshayes & Milne-Edwards, Hist. nat. anim. s. vertébres, ed. 2, vol. 10, p. 48 (refers to Kiener, fig. 5, junior = fig. 5a, 5a).
- 1835 *Purpura clathrata* Lamarck, Kiener (*pars*), Spéc. gén. icon. coq. viv., vol. 8, p. 15, pl. 3, figs. 5a, 5a (*non Ricinula clathrata* Lamarck, 1816).
- 1968 *Drupa clathrata* Lamarck, Taylor, Phil. Trans. Roy. Soc. London, ser. B, vol. 254, p. 201 (*non Ricinula clathrata* Lamarck, 1816).

Types—Two syntypes of *Ricinula miticula* are in the Muséum d'Histoire Naturelle, Geneva. The slightly larger specimen, length 26.3 mm (Pl. 28, fig. 3), no. 1101/13/1, is here selected as the lectotype of *R. miticula*. No type locality was given, and Mahébourg, Mauritius, is here designated as the type locality (specimens in AMNH).

Nomenclature—Kiener (1835) regarded *Ricinula miticula* of Lamarck to be a juvenile of *R. clathrata*, but his figures are typical *R. clathrata miticula*.

Records—(Specimens): MAURITIUS: Gris Gris, 1 mi. ESE of Souillac; Vacoas Point, 3 mi. S. of Mahébourg; Point Pimente, N. side Arsenal Bay; Pointe Fayette; Caves Point (all ANSP); Mahébourg (AMNH); near Port Louis (MCZ). COCOS-KEELING ISLANDS: N. end of Horsburgh Id (ANSP). CHRISTMAS ISLAND: Lily Beach; Greta Beach; Dolly Beach (all WAM). INDONESIA: Timor (AMS).

Records—(Literature—identified as "clathrata"): SEYCHELLES ISLANDS: Coetivy Id. (Melville, 1909, p. 104); Mahé (Taylor, 1968, p. 201). MADAGASCAR: (Dautzenberg, 1923, p. 35). MAURITIUS: (Viader, 1937, p. 32). REUNION ISLAND: (Deshayes, 1863, p. 115).

Drupa grossularia Röding, 1798

(Pl. 2, figs. 23, 24; Pls. 31, 32)

Range—From the Cocos-Keeling Islands in the Indian Ocean to West Australia and throughout the Pacific to Hawaii and the Marquesas Islands.

Remarks—This is a very distinctive species with the large digitate processes and solid yellow aperture distinguishing it from all other members of the genus except *Drupa lobata* (Blainville), a dark brown apertured form inhabiting the Indian Ocean.

Habitat—Lives clinging to rocks exposed at low tide or in a few feet of water on windward rather than leeward reefs. Demond (1957) records a specimen taken alive at a depth of 32-38 feet in a lagoon west of Saipan.

Description—Shell 18 to 33 mm ($\frac{3}{4}$ to $1\frac{1}{4}$ inches) in length, ovate, spire very short, body whorl large. Whorls spirally ribbed with low rounded nodules most common; nodules often as siphon-

Subgenus Drupina Dall, 1923Type: *Drupa grossularia* Röding, 1798

Shell sub-ovate, strong, heavy, flattened dorso-ventrally, spire short; whorls ribbed spirally with inconspicuous nodules, surface sculptured with minute imbricated scales; columella doubly plicated axially, outer lip with two well developed marginal processes. Operculum typical for genus. Radula with a broad but low rachidian which has from 13-18 cusps; the central cusp may be large or small and the 2 flanking side-cusps are tridentate and usually smaller than the central cusp. The lateral teeth are small and slender, with a smaller and more rounded base than in *Drupa sensu stricto*.

The 2 members of this subgenus have a portion of the outer lip expanded as two conspicuous lobate processes. The process develops as the individual reaches maturity and thus is not laid down and re-absorbed by the mantle as the shell grows; instead the processes are thickened, extended and often bifurcated. Both species of the subgenus *Drupina* are Indo-Pacific in distribution.

Synonymy—

1923 *Drupina* Dall, Proceedings of the Academy of Natural Sciences of Philadelphia, vol. 75, p. 303. Type-species by original designation: *Ricinula digitata* Lamarck, 1816 [= *Drupa grossularia* Röding, 1798].

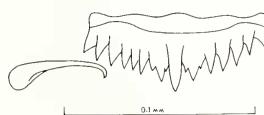


Plate 31. Radula of *Drupa (Drupina) grossularia* Röding. Half a transverse row; Fiji Islands.

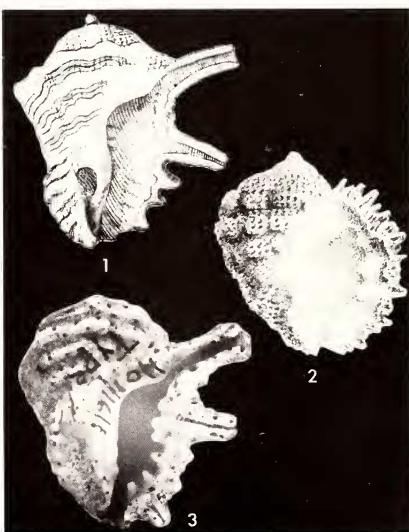


Plate 32. *Drupa (Drupina) grossularia* Röding.

Fig. 1. Lectotype figure of *Drupa grossularia* Röding, from Martini, 1777, Syst. Conchylien-Cabinet, vol. 3, pl. 102, fig. 978.

Fig. 2. Type figure of *Purpura laurentiana* Petit de la Saussaye, from Journal de Conchylogie, 1850, vol. 1, pl. 13, fig. 2; Pacific Ocean (20.0 x 16.0 mm)—juvenile specimen.

Fig. 3. Lectotype of *Ricinula digitata* Lamarck (MHNG no. 1101/16/1; 22.4 x 22.0 mm).

ous tubercles near the margin of the aperture. Sculpture of crisp, well-defined scales; detail of sculpture retained only in well preserved individuals. Aperture in adult stage, linear, constricted by 5 or 6 singularly arranged, close-set teeth projecting from the outer lip, and a columellar callus with from 2-5 inconspicuous plications. Columella doubly folded axially. Aperture of juvenile specimens expanded. In adults, siphonous, digitate processes extend from the first and second ribs of the body whorl. The processes tend to bifurcate at maturity; canal of the upper process canaliculate, lower canal generally sealed in the adult stage. Exterior of shell white or cream, aperture yellow to orange, denticles of outer lip white, columellar plications faintly whitish. Operculum typical for the genus, dark orange-brown in color.

The radula is of a considerably modified drupine type and has been described in the subgeneric diagnosis. The size and length of the central tooth and accessory lateral denticles are quite variable.

Measurements (mm)—(including digitations; all specimens with a mature lip).

length	width	
32.7	33.6	Limu, Niue Island
32.0	30.9	S. Luzon Id., Philippines
23.2	22.2	Kavieng, New Ireland
22.4	22.0	Lectotype of <i>digitata</i> Lamarck
18.7	18.3	Bougainville, Solomon Ids.

Synonymy—

- 1685 — Lister, Hist. Syn. Meth. Conchyliorum, pl. 804, fig. 12.
- 1758 — Seba, Locupl. rer. nat. thes. descriptio, vol. 3, pl. 60, fig. 48.
- 1777 "Murex Morum globosum" Martini, Syst. Conchylien-Cabinet, vol. 3, p. 280, pl. 102, figs. 978, 979 (non binomial).
- 1791 *Murex neritoideus* Gmelin (*paris*), Systema Naturae, ed. 13, p. 3537 (refers to Seba, *op. cit.*, Lister, *op. cit.*, and Martini, figs. 978, 979 only) [non Linnaeus, 1767].
- 1798 *Drupa grossularia* Röding, Museum Boltenianum, p. 55 (refers to Martini, *op. cit.*) [no locality given]; 1913 Hedley, Nutilus, vol. 27, no. 7, p. 80; 1957 Kaicher, Indo Pacific Sea Shells (Muricaceae, Buccinaceae), pl. 4, fig. 4; 1970 Salvat, Cahiers du Pacifique, no. 14, p. 46.
- 1816 *Ricinula digitata* Lamarck, Tableau Encyclopédique Méthodique, p. 2, pl. 395, figs. 7a, b (no locality given); 1822 Lamarck, Hist. nat. anim. s. vertébrés, vol. 7, p. 232; 1827 Crouch, Illust. Introd. Lamarck's Conchology, p. 36, pl. 18, fig. 8; 1842 Reeve (*paris*), Conchologia Systematica, vol. 2, p. 215, pl. 256, fig. 3 only; 1846 Reeve, Conchologia Iconica, vol. 3, pl. 1, fig. 2a (Lord Hood Id. = S. Marutea Id.); 1859 Chemu, Manuel de Conchyliologie, vol. 1, p. 168, text fig. 815; 1880 Tryon, Manual of Conchology, vol. 2, p. 185, pl. 56, fig. 191 and pl. 57, fig. 203; 1933 Dautzenberg & Bouge, Journal de Conchyliologie, vol. 77, p. 237.
- 1842 *Purpura monstruosa* Lesson, Rev. Zool. Cuvierienne, vol. 5, App. p. 108 [Gambier Islands].
- 1823 *Murex fimbriatus* Mawe, Linn. Syst. Conchology, p. 131, pl. 26, fig. 4 (non Brocchi, 1814; nec Lamarck, 1822).
- 1825 *Murex ricinus* Wood, Index Testaceologicus, pl. 26, fig. 51a (non Linnaeus, 1758).
- 1832 *Purpura digitata* Lamarck, Blainville, Nouv. Ann. Mus. d'Hist. Nat. Paris, ser. 3, vol. 1, p. 210; 1833 Quoy & Gaimard, Voyage L'Astrolabe, vol. 2, p. 578, pl. 39, figs. 20-22 (shell, animal and operculum) [Carteret Harbour, New Ireland]; 1835 Kiener, Spéc. gén. icon. coq. viv., vol. 8, p. 16, pl. 3, figs. 6, 6a.
- 1850 *Purpura laurentiana* Petit de la Saussaye, Journal de Conchyliologie, vol. 1, no. 4, p. 403, pl. 13, fig. 2 (Pacific Ocean) [juvenile specimen].
- 1853 *Pentadactylus grossularius* Bolten, H. & A. Adams, Gen. Rec. Mollusca, vol. 1, p. 129 and vol. 3, pl. 13, fig. 6c; 1875 Troschel, Gebiss d. Schnecken, vol. 2, p. 133, pl. 13, fig. 1 (radula).
- 1880 *Ricinula hystrix* var. *laurentiana* Petit, Tryon, Manual of Conchology, vol. 2, p. 184, pl. 56, fig. 192 (juvenile specimen).
- 1908 *Pentadactylus (Pentadactylus) digitatus* Lamarck, Horst & Schepman, Cat. Syst. Moll. Mus. Hist. Nat. Pays-Bas, vol. 13, p. 157.
- 1929 *Drupa grossularia* Röding, Iredale, Mem. Queensland Museum, vol. 9, pt. 3, p. 290; 1961 Rippangale & McMichael, Queensnl. & Gt. Barrier reef Shells, p. 102, pl. 13, fig. 2; 1962 Kira, Shells west. Pacific in color, p. 62, pl. 24, fig. 3; 1965 Arakawa, Venus: Jap. Journ. Malacology, vol. 24, no. 2, p. 116, pl. 13, figs. 8-10 (radula); 1969 Cernohorsky, Veliger, vol. 11, no. 4, p. 303, pl. 48, fig. 11 (shell), text fig. 7 (radula); 1971 Wilson & Gillett, Australian Shells, p. 92, pl. 61, figs. 5, 5a; 1971 Kay, Pacific Science, vol. 25, pp. 263, 275.
- 1952 *Sistrum digitatum* Lamarck, Morris, Field Guide to shells Pacific coast and Hawaii, p. 187, col. pl. 5, fig. 5; pl. 39, fig. 3.
- 1965 *Drupa grossularia* (*sic*) (Röding), Wu, Bull. Inst. Zool. Acad. Sinica, vol. 4, p. 99, text figs. 20, 21 (radula); 1967 Habe & Kosuge, Stand. Book Jap. shells in color, vol. 3, p. 70, pl. 27, fig. 22 (invalid emendation).
- 1968 *Drupa (Drupina) grossularia* Röding, Orr Maes, Proceedings of the Academy of Natural Sciences of Philadelphia, vol. 119, no. 4, p. 130.

Types—The holotype of *Drupa grossularia* is no longer traceable and the specimen figured by Martini on plate 102, figs. 978, 979 (Pl. 32, fig. 1) which was cited by Röding, is here designated as the lectotype of the species. Two syntypes of *Ricinula digitata* Lamarck, are in the Muséum d'Histoire Naturelle, Geneva, and the 22.4mm long specimen, no. 1101/16/1, which most closely corresponds to Lamarck's cited dimensions, is here selected as the lectotype (Pl. 32, fig. 3). The holotype of *Purpura laurentiana* Petit de la Saussaye, is in the Muséum National d'Histoire Naturelle, Paris (Journ. de Conchyliologie coll.). No type locality was given by Röding for *D. grossularia*, and the earliest record of Carteret Harbour, New Ireland, by Quoy & Gaimard,

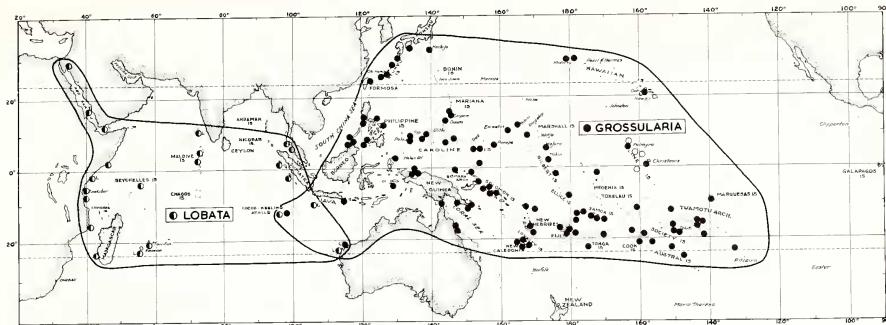


Plate 33. Geographical distribution of the species *Drupa (Drupina) grossularia* Röding, in the Pacific and East Indian Oceans (full circles) and *D. (D.) lobata* (Blainville) in the Indian Ocean (half-open circles).

1833, is here designated as the type locality, as well as for *Purpura digitata* Lamarck. Two syntypes of *Purpura monstruosa* Lesson, which are said to be "typical" examples of *D. grossularia*, are in the Muséum National d'Histoire Naturelle, Paris (*teste* G. Richard).

Nomenclature—There can be no doubt as to Röding's concept of *Drupa grossularia*, as he, Schumacher and Lamarck, all cite identical figures in Martini, 1777. Petit's *Purpura laurentiana* is a young specimen in which the mature lip has not started to form and has the whorls covered with a foreign growth (Pl. 32, fig. 2). A similar juvenile is illustrated on Pl. 2, fig. 24.

Records—COCOS-KEELING ISLANDS: S. end of Home Id. (ANSP). INDONESIA: Marudu Bay, N. Borneo (ANSP) Malawali Channel, N. Borneo (AMNH; USNM); Bali; Mortai Id. (both AMNS); Oong Bay, Mandidi Id., Moluccas (MCZ); Pulau Pombo, Wasi, Amboi Id. (FMNH). PHILIPPINES: Recorded from many localities throughout the Archipelago: Luzon; Mindoro; Catanduanes; Busanga; Balabac; Sulu Archipelago (AMNH; ANSP; MCZ; USNM); Borongan village, E. Samar Id. (AIM). FORMOSA (Taiwan): Now Wow (USNM). RYUKYU ISLANDS: Sobe; Kadena; Mekaniko; Onna reefs; Bolo Point, all Okinawa (all AMNH); Miyako (FMNH). JAPAN: Hachijo Id., 275 mi. S. of Tokyo; Tosa, Shikoku; Oshima; Osumi (all ANSP). MARIANAS: Lagunan Tanapag, Saipan; Agat Bay, Guam (both ANSP); Tinian Id. (MCZ). PALAU ISLANDS: Helen reef, Koror; Babelthau (both ANSP). CAROLINE ISLANDS: S. of Garabayo; Kayangel; Rattakadokoru; Ngaruangl; Ngangersul; Ponape; Yap (all ANSP); Elato Atoll; Lamotrek Atoll; Sataval Atoll; Kapingamarangi (all USNM); Lukunor (AMNH). MARSHALL ISLANDS: Eniwetok Atoll; Bikini Atoll; Kwajalein Atoll (all USNM); Arno Atoll (AMNH). ADMIRALTY ISLANDS: Manus Id. (DM). NEW BRITAIN: Rabaul (AMNH; USNM). NEW IRELAND: Kaving (AMNH). NEW GUINEA: Aoeri Ids., Geelvink Bay; SW Biak, Schouten Ids.; Wooi Bay, Japen Id.; 1 mi. NE Mioes Woendi, Padaido Ids. (all ANSP); Samarai, Papua; Port Moresby, Papua (both

AMNH); Milne Bay, Papua (USNM). AUSTRALIA: Torres Strait (Shirley, 1912, p. 102); Queensland: Michaelmas Cay, off Cairns; Bramble Bay, off Lucinda (both AMNS); West Australia: Barrow Id. (Wilson & Gillet, 1971, p. 92). SOLOMON ISLANDS: Vanikoro Id., Santa Cruz group; Reef Id., Santa Cruz group (both AMNS); Kieta, Bougainville Id.; Lutue, Choiseul Id.; Ataa, N. Malaita Id. (all AMNH); Ugi Id., Shortland group (USNM); Ticopia Id., (AIM); NEW HEBRIDES: Meli Id., SW Efate Id.; Pango Point, Efate Id. (both AIM); Pentecost Id. (Powell coll.). LOYALTY ISLANDS: Lifu (AMNS). NEW CALEDONIA: Touho (AMNH); Bourail; 7 mi. SW Gatope Id., Voh (both ANSP). FIJI ISLANDS: 3 mi. NE Tumutau, Vanua Levu (MCZ); Suva Harbour, S. Viti Levu; Ogea Levu, Ogea, Lau group (both USNM); Wadigi Id., Mamamana group (WOC coll.). GILBERT ISLANDS: Abainga (MCZ); Onotoa Atoll, Kingsmill Ids. (USNM). ELLICE ISLANDS: Funafuti (AMS; AIM). WALLIS & FUTUNA: Nukuhifala, Wallis Id., W. coast of Uvea, Wallis Ids.; E. side of Faioa, Wallis Ids. (all USNM); Anse de Sigave, Hoorn Id., Futuna Ids. (USNM). SAMOA ISLANDS: Asan Harbour, Savaii (USNM); Vailele Bay, Upolu Id. (ANSP); Satalo Id., Upolu Id. (AIM); Apia, Upolu Id. (Powell coll.); Pago Pago, Tutuila Id. (AMNH; MCZ). TONGA ISLANDS: Ha'ateifo, Tongatapu (USNM). NIUE ISLAND: Linu (AMNH); Alofi (USNM). PHOENIX ISLANDS: Enderbury Id. (USNM). COOK ISLANDS: Akamaru, Manihiki Atoll (ANSP); Bird's Id. and Tom's Id., Palmerston Atoll; Motu Akamai, Aitutaki (all USNM); Mauke (ANSP); several localities on Rarotonga (MCZ; USNM; AIM). AUSTRALIAN ISLANDS: Rurutu; Raivavae (both USNM). SOCIETY ISLANDS: N. of Fare, Huahine; Fareidine, NW Moorea; Papeete, Tahiti (all USNM). TUAMOTU ISLANDS: Raraoa Id.; Lord Hood Id. [= S. Marutea Id.] (both AMNH); Makemo Id.; Tora Atoll (both ANSP); Nengonego Id. (USNM). GAMBIER ISLANDS: Mangareva Id. (USNM). MARQUEESA ISLANDS: (USNM; ANSP). LINE ISLANDS: Palmyra Id.; Flint Id.; Christmas Id. (all ANSP); Fanning Id.; Kingman reef; Washington Id.; Jarvis Id. (all Ig, 1971, p. 275). HAWAIIAN ISLANDS: Kure Id.; Midway Id. (both USNM). MAKUA, OAHU (Adams, 1967, p. 4).

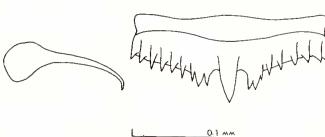


Plate 34. Radula of *Drupa (Drupina) lobata* (Blainville). Half a transverse row; Veenkens Bay, S. Pagi Id., Indonesia.

Drupa lobata (Blainville, 1832)

(Pl. 2, figs. 25, 26; Pls. 34, 35)

Range—From the Red Sea and East Africa through the Indian Ocean to Thailand, Sumatra and West Australia.

Remarks—Despite its closeness to *Drupa grossularia*, the present chocolate-mouthed species seems to be a distinct form which replaces the yellow-mouthed species in the Red Sea and Indian Ocean. Their ranges are known to overlap in the Cocos-Keeling Islands where the two forms were collected at Home Island and no intermediates were found (Ostheimer and Orr Maes leg.), and along the coast of West Australia (specimens in West Australian Museum).

Habitat—On intertidal wave-swept reefs. In the Cocos-Keeling Islands it was found on the tops and sides of rocks near shore on the seaward reefs, and on the seaward ends of passes (Orr Maes, personal communication).

Description—Shell 18 to 32 mm (¾ to 1⅓ inches) in length, very similar to *Drupa grossularia* Röding, but differing in having a chocolate-brown aperture, a brownish dorsum, and in having a wider, more lobate digitate process extending from the first rib on the body whorl. This process shows no tendency to bifurcate as it does in *D. grossularia*, and the canal remains open in the adult.

The radula is similar to that of *D. grossularia*; the side-cusps of the rachidian are short, broad and trifid, and are followed by 6 moderately deeply rooted lateral denticles.

Measurements (mm)—(including digitations; all specimens with a mature lip)

length	width	
33.2	33.0	Mauritius
28.6	27.8	Kiwengwa, Zanzibar
26.5	26.3	Syntype of <i>dactyloides</i> Schumacher
26.2	27.5	Eilat, Gulf of Aqaba
18.5	17.5	Zanzibar

Synonymy—

- 1817 *Ricinella dactyloides* Schumacher, Essai nouv. système, p. 241 (refers to Martini, 1777, vol. 3, pl. 102, figs. 978, 979 = *Drupa grossularia* Röding) [no locality given] (*nomen oblitum*).
 1823 *Ricinula digitata* Lamarck, Sowerby, Gen. Rec. foss. shells, pt. 18, pl. 235, figs. 3, 4 (no locality given) [non Lamarck, 1816].

- 1832 *Purpura lobata* Blainville, Nouv. Ann. Mus. d'Hist. Nat. Paris, ser. 3, vol. 1, p. 210, pl. 9, fig. 7 (no locality given); 1835 Kiener, Spéc. gén. icon. coq. viv., vol. 8, p. 18, pl. 3, fig. 7.
 1842 *Ricinula digitata* var. Lamarck, Reeve (*pars*), Conchologia Systematica, vol. 2, p. 215, pl. 256, fig. 4 only (non Lamarck, 1816).
 1844 *Ricinula digitata* var. *fusca* "Sowerby," Deshayes & Milne-Edwards, Hist. Nat. anim. s. vertébrés, ed. 2, vol. 10, p. 53 (no locality given) [published in synonymy of *R. lobata* Blainville—refers to Sowerby, 1823, pl. 235, fig. 4] (non *R. fuscus* Küster, 1862).
 1846 *Ricinula digitata* var. *B.* Reeve, Conchologia Iconica, vol. 3, pl. 1, fig. 2b (Seychelles Ids.) [non Lamarck, 1816].
 1850 *Ricinula digitata* var. *lobata* Blainville, Tryon, Manual Conchology, vol. 2, p. 185, pl. 57, fig. 205.
 1896 *Ricinula lobatus* Blainville, Shopland, Journ. Bombay Soc. Nat. Hist., vol. 10, p. 220.
 1903 *Sistrium digitatum* (var. *lobata*) E. A. Smith in Gardner, Fauna & Geog. Maldives & Laccadive Archipelago, p. 609.
 1919 *Drupa digitata* var. *lobata* Blainville, Cooke, Proc. Malac. Soc. London, vol. 13, pt. 4, p. 101 (description of radula); 1937 Viader, Mauritius Inst. Bull. vol. 1, pt. 2, p. 32.
 1913 *Ricinula lobata* Blainville, Hedley, Nautilus, vol. 27, no. 7, pp. 79, 80; 1922 Hornell, Madras Fish. Dept. Bull., no. 6, p. 217.
 1950 *Drupa (Drupina) grossularia lobata* Blainville, Abbott, Bull. Raffles Museum, vol. 22, p. 80.
 1956 *Drupa (Drupina) lobata* (Blainville), Franc. Ann. L'Inst. Océanogr. Monaco, N.S. 32, p. 37 (Île Abulat, Red Sea); 1967 Orr Maes, Proc. Acad. Nat. Sci. Philadelphia, vol. 119, no. 4, p. 130, pl. 11, fig. E.
 1961 *Drupa lobata* Spry, Tanganyika Soc. Notes & Record, no. 56, p. 21, pl. 7, fig. 142.
 1969 *Drupina lobata* (Blainville), Cernohorsky, Veliger, vol. 11, no. 4, p. 303 1970 Heinicke, Hawaiian Shell News, vol. 18, no. 7, p. 6, text fig.; 1971 Wilson & Gillett, Australian Shells, p. 92, pl. 61, fig. 4 (Pt. Cloates, West Australia).

Types—The type specimen of *Purpura lobata* Blainville, is presumably in the Muséum National d'Histoire Naturelle, Paris. Five probable syntypes of *Ricinella dactyloides* Schumacher, are in the Zoological Museum, Copenhagen. Four of these specimens have the letters "Sp" marked either in the aperture or on the dorsum, and these originated from the Spengler collection. One specimen is marked "Sch" [= Schumacher] inside the aperture (Pl. 35, fig. 1). The type locality of *D. lobata* is here designated as Mogadiscio, Somalia.

Nomenclature—When Schumacher described *Ricinella dactyloides*, his diagnosis consisted of only the three words "labio externo digitato"; for an illustration he referred to Martin's figures 978, 979, which represent *Drupa grossularia* Röding. However, the extant and probable syntypes of *Ricinella dactyloides* are referable to the species *Drupa lobata* (Blainville), and Schumacher's taxon would in effect have 15 years

Plate 35. *Drupa (Drupina) lobata* (Blainville).

Fig. 1. Probable syntype of *Ricinella dactyloides* Schumacher; marked "Sch[umacher]" inside aperture (ZMC; 26.5 x 26.3 mm).

Fig. 2. Probable syntype of *R. dactyloides* Schumacher; marked "Sp[engler]" inside aperture (ZMC; 26.8 x 25.8 mm).

priority over Blainville's. Since Schumacher's name has not once been applied to a taxon as the valid name during the last 50 years, it is considered to be an unused senior synonym. The taxon *Purpura lobata* Blainville, however, has been in general current use during the preceding

fifty years, and has been used by 5 different authors in 10 publications (see Declaration 43 of the ICZN; Bull. Zool. Nomencl., vol. 27, pts. 3/4, p. 135).

Hedley (1913) suggested that the name *fusca* Deshayes & Milne-Edwards, 1844, be applied to the present species on the mistaken belief that Blainville had proposed *Purpura lobata* for the yellow-apertured *Drupa digitata* (Lamarck) [= *D. grossularia* Röding]. Blainville (1832, p. 210) clearly states: "couleur d'un brun-marron en dehors et à la circonference de l'ouverture, blanche en dedans"; the type-figure given by Blainville (1832, pl. 9, fig. 7) is also an excellent representation of the dark brown apertured form, despite the lack of cited locality.

Records—RED SEA: Eilat, Gulf of Aqaba, Israel (A. Hadar; K. Haam; AMNH; DMNH); Ilé Abulat (Franc, 1956, p. 37); Jidda, Saudi Arabia (DMNH); GULF OF ADEN: Aden (Shopland, 1896, p. 220). EAST AFRICA: 9 mi. N. of Mogadiscio, Somalia (ANSP); at 19 km marker, N. of Mogadiscio, Somalia (AMNH); Diana Beach, Kenya (Heimicke, 1970, p. 7); 15 mi. SSE of Dar-es-Salaam, Tanzania; 4 mi. ESE of Dar-es-Salaam, Tanzania (both MCZ); Mozambique City, Mozambique (ANSP). ZANZIBAR: Pange Id.; Kiwengwa; Mangapivani (all ANSP). SEYCHELLES: Beau Vallon Beach, Mahé (ANSP). MADAGASCAR: Grande Recife, W. end of ship pier, Tuléar; Grande Recife, W. of airport, Tulear (both MCZ). REUNION: (Deshayes, 1863, p. 115). MAURITIUS: NW side of Tamarin Bay (ANSP). MALDIVE ISLANDS: Imma Id., N. Male Atoll; Fodifollo Atoll; Ari Atoll (all ANSP). LACCADIVE ISLANDS: (Hornell, 1922, p. 217). THAILAND: Goh Phi Phi; Goh Huayong, Similan Ids. (both USNM). COCOS-KEELING ISLANDS: N. tip West Id.; S. end of Direction Id.; S. end Home Id. (all ANSP). CHRISTMAS ISLAND: (Tomlin, 1935, p. 79). INDONESIA: Pulau Siburu, N. of Sipora, S.W. Sumatra; Pulau Bai, Batu group, off Sumatra; W. shore Veeekens Bay, S. Pagi Id. (all USNM). WEST AUSTRALIA: W. of Ningaloo homestead, Pt. Cloates, 22°42'S and 113°39'E (WAM).

INDEX TO DRUPA NAMES IN VOL. 3 NO. 13

The number following the name refers to the pagination found at the top of the page. The column at right is the looseleaf pagination. All new names are in bold face type.

aesculus Röding, 9	14-809	laurentiana Petit de la Saussaye, 36	14-860
albolabris Blainville, 20	14-824	lobata Blainville, 38	14-862
album Montfort, 20	14-824		
arachnoides Lamarck, 20	14-824		
Azumamorula , 8	14-808		
baylei Coss. & Lambert, 5	14-805	mancinella Röding, 9	14-809
bollonsi Suter, 7	14-807	miticula Lamarck, 33	14-847
botroides Röding, 9	14-809	monstrosa Lesson, 37	14-861
Canrena Link, 14	14-818	morum Röding, 15	14-819
chamaemorus Röding, 9	14-809	muricina Röding, 9	14-809
Condonia Hertlein, 8	14-808	mutica Lamarck, 8	14-808
cornus Röding, 9	14-809		
clathrata Lamarck, 31	14-845		
dactyloides Schumacher, 38	14-862	neritoidea Link, 16	14-820
digitata Lamarck, 36	14-860	neritoideus Linnaeus, 16	14-820
Drupa Röding, 14	14-818	neritoideus Mawe, 20	14-824
Drupina Dall, 35	14-859	nodosa Linnaeus, 16	14-820
Drupinae , 13	14-817	nodus Gmelin, 28	14-842
elegans Broderip & Sowerby, 24	14-828	Pentadactylus Mörcb, 14	14-818
fimbriatus Mawe, 36	14-860	pisolina Lamarck, 8	14-808
fragum , Röding, 28	14-842	purpurata Schumacher, 28	14-842
fusca Deshayes & Edwards, 38	14-862	Purpurinae , 13	14-817
glans Röding, 9	14-809	puruensis K. Martin, 5	14-805
globosa Mörcb, 16	14-820	reeveana Crosse, 28	14-842
globosum Martini, 16	14-820	rhombiformis K. Martin, 5	14-805
grossularia Röding, 35	14-859	Ricinella Schumacher, 27	14-841
hadari Emerson & Cernohorsky, 23	14-827	Ricinula Lamarck, 14	14-818
hammai Howe, 8	14-808	Ricinulus Demarest, 14	14-818
hericinus Martini, 28	14-842	ricinus Linnaeus, 19	14-823
hippocastanum Wood, 28	14-842	rubuscaesius Röding, 20	14-824
horrida Lamarck, 16	14-820	rubuscestus Dall, 20	14-824
hystrix Linnaeus, 20	14-824	rubusidaeus Röding, 27	14-841
hystrix auctt., 28	14-842		
iodostoma Lesson, 18	14-822	Sistrum Montfort, 14	14-818
jodostoma Boettger, 19	14-823	smithi Brazier, 8	14-808
		spathulifera Blainville, 28	14-842
		speciosa Dunker, 30	14-844
		styriaca Stur, 5	14-805
		Thaidinae , 13	14-817
		trapa Röding, 9	14-809
		tribulus Röding, 20	14-824
		uva Röding, 9	14-809
		violacea Schumacher, 16	14-820
		vitiensis Pilsbry <i>in</i> P. & B., 9	14-809
		walkerae Pilsbry & Bryan, 9	14-809